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FINAL

**SWMU 336
RCRA FACILITY INVESTIGATION REPORT
MCB CAMP LEJEUNE, NORTH CAROLINA**

CONTRACT TASK ORDER 0091

JANUARY 2006

Prepared for:

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NAVAL FACILITIES
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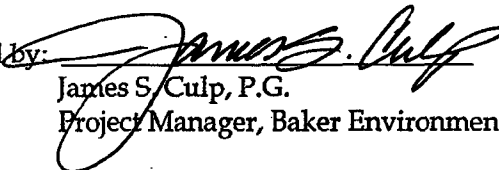
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SWMU 336
RCRA Facility Investigation Report
MCB Camp Lejeune

Jacksonville, North Carolina

Contract Task Order Number - 0091
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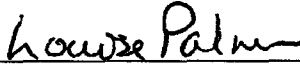
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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AT	Averaging Time
ATSDR	Agency for Toxic Substance and Disease Registry
Baker	Baker Environmental, Inc.
bgs	below the ground surface
BERA	Baseline ERA
BTAG	Biological Technical Assistant Group
CaCO ₃ /L	Calcium Carbonate per Liter
CCME	Canadian Council of Ministers of the Environment
CDIs	Chronic Daily Intakes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CNO	Chief of Naval Operations
COPCs	Chemicals of Potential Concern
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
CSFs	Cancer Slope Factors
CSI	Confirmatory Sampling Investigation
CT	Central Tendency
CTO	Contract Task Order
DADs	Dermally-Absorbed Doses
DoN	Department of the Navy
DOT	United States Department of Transportation
EF	Exposure Frequency
ERA	Ecological Risk Assessment
ET	Exposure Time
ft/d	feet per day
gpm	Gallons Per Minute
gpd	Gallons Per Day
GPS	Global Positioning System
HA	Health Advisories
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Amendments

ACRONYMS AND ABBREVIATIONS

(Continued)

ID	Inside Diameter
ILCR	Incremental Lifetime Cancer Risk
IDW	Investigation Derived Waste
IEUBK	Integrated Exposure Uptake Biokinetic
ILM	Inorganic Low Medium
IMAC	Interim Maximum Allowable Concentrations
IR	Installation Restoration
IRIS	Integrated Risk Information System
J	Estimated Result
2L Standards	North Carolina Water Quality Standards for Groundwater
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCLGs	Maximum Contaminant Levels Goals
MDL	Maximum Detection Limit
mg/kg	Milligrams per Kilogram
MHSPE	Ministry of Housing, Spatial Planning and Environment
msl	Mean Sea Level
NAWQC	National Ambient Water Quality Criteria
NCAC	North Carolina Administrative Code
NC DENR	North Carolina Department of Environment and Natural Resources
NCEA	National Center for Environmental Assessment
NCWQS	North Carolina Water Quality Standards
NPL	National Priorities List
NTUs	Nephelometric Turbidity Units
OEPA	Ohio Environmental Protection Agency
OLM	Organic Low Medium
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PEF	Particulate Emission Factor
PRGs	Preliminary Remediation Goals
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RAC	Remedial Action Contractor
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recover Act
RfC	Reference Concentration
RfDs	Reference Doses
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RME	Reasonable Maximum Exposure
RPD	Relative Percent Difference

ACRONYMS AND ABBREVIATIONS

(Continued)

SAF	Skin Adherence Factor
SLERA	Screening Level Ecological Risk Assessment
SOW	Statement of Work
SQL	Sample Quantitation Level
STGCs	Soil-to-Groundwater Concentrations
S.U.	Standard Units
SVOCs	Semi-Volatile Organic Compounds
SW	Solid Waste
SWMUs	Solid Waste Management Units
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TSD	Treatment, Storage, and Disposal (Facility)
the Base	Marine Corps Base Camp Lejeune
the SWMU	Solid Waste Management Unit 336
U	Not Detected
UCL	Upper Confidence Limit
µg/L	Micrograms per Liter
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
VKT	Vehicle Kilometers Traveled

EXECUTIVE SUMMARY

This report presents the investigation procedures and results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Solid Waste Management Unit (SWMU) 336 (the SWMU) at Marine Corps Base (MCB) Camp Lejeune, North Carolina (the Base). The primary goal of this RFI is to adequately characterize the SWMU and determine the potential for future corrective action (if any) based on risks to human health and the environment. Specifically, the field information generated during the RFI was used to meet the following objectives:

- Supplement and/or verify the environmental setting at the SWMU, including hydrogeology, geology, hydrology, topography, aquifer characteristics, and any other anthropogenic influences that may affect the hydrology or contaminant pathways at the SWMU.
- Characterize the source of contamination through collection of analytical data, and evaluate the migration and dispersal characteristics of the contamination.
- Characterize the extent, origin, direction, and rate of movement of contamination through collection of soil and groundwater samples in the vicinity of the SWMU.
- Evaluate potential receptors by collecting data describing human populations and environmental systems susceptible to contaminant exposure.
- Evaluate the risk of any contaminants associated with the SWMU to human health and the environment.
- Provide recommendations for site management.

SWMU 336 is located in the Marine Corp Air Station (MCAS) New River area just south of White Road inside building AS-4106. It consisted of a pair of paint stripping vats located in a separate room within Building AS-4106. The years of operation for this SWMU are unknown. The old paint stripping vats have been removed and replaced with one new upgraded paint stripper. Concerns regarding the potential that stripping agents may have exited the building occupying the SWMU via a drain line prompted investigation of this SWMU. The RFI field activities included surface and subsurface soil sampling as well as groundwater sampling.

To facilitate a comprehensive understanding of the nature and extent of contamination at the SWMU, data from this RFI was supplemented with information and data from the Phase I Confirmatory Sampling Investigation (CSI) (September 1997) and Phase II CSIs conducted in 2002 and 2003, which included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and RCRA metals in soil and groundwater samples. The concentrations of constituents detected in the samples were compared to established regulatory-driven screening values. As a secondary comparison, metals detected at concentrations exceeding the regulatory-driven screening values were compared to background screening values developed for Camp Lejeune.

Detections of methylene chloride and cadmium have exceeded the applicable screening criteria in soils. These detections are limited to sample locations SWMU336-TW01-00 and SWMU336-TW04-04. There is little correlation between soil and groundwater contamination at the SWMU. Neither methylene chloride nor cadmium was detected in the groundwater. Both of these contaminants could be attributable to SWMU related activities.

Groundwater contamination is limited to tetrachloroethene (PCE) in shallow groundwater. PCE was detected in three of the six temporary wells installed during the Phase II CSI activities in 2002 and 2003. These three detections exceeded the North Carolina 2L Standard of 0.7 ug/L and the USEPA Tap Water PRG of 0.66 ug/L. Groundwater samples collected during the RFI revealed no other detections exceeding the applicable screening criteria. Therefore, the groundwater contamination was localized around those three temporary well locations. The observed PCE contamination in groundwater is likely due to SWMU-related activities, but there is no clear source evident in shallow soils. PCE is typically used as a degreasing agent and likely used prior to paint stripping activities at the SWMU.

Current land use scenarios were evaluated in the baseline Human Health Risk Assessment (HHRA) for SWMU 336. There were no unacceptable carcinogenic risks or adverse noncarcinogenic hazard levels calculated that exceeded USEPA's acceptable criteria for the current military Base personnel, future adolescent trespasser, or future construction worker.

There were no adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the future adult and child residents. The total Incremental Lifetime Cancer Risk (ILCRs) exceeded the USEPA acceptable range of 1×10^{-6} to 1×10^{-4} for the future adult and child residents when considering the Reasonable Maximum Exposure (RME), or reasonable maximum exposure, scenario. This is caused by ingestion of and dermal contact with PCE in the shallow groundwater. However, it should be noted that the total ILCRs for the adult and child were within USEPA's acceptable range under the Central Tendency (CT), or average, exposure scenario.

It should also be noted that the maximum detected concentration of PCE in the groundwater data set came from sample location SWMU336-GW01, which was collected from temporary well SWMU336-TW01 during the Phase II CSI. It should be noted that PCE was not detected in any of the groundwater samples collected during the RFI. Furthermore, the maximum detected concentrations were used in the risk calculations because there was no definitive plume found at this SWMU. The use of maximum concentrations from SWMU336-GW01 likely overestimates the actual risks to these receptors from the SWMU. It is also unlikely that the shallow groundwater at the SWMU would be used as potable water source.

Therefore, based on the quantitative results of the baseline HHRA, unacceptable risk was calculated for future residents upon exposure to groundwater investigated at the SWMU. However, consideration should be given to the conservatism added to the groundwater exposure evaluation.

Based on the results of the Screening Level Ecological Risk Assessment (SLERA) and Step 3A of the Baseline Ecological Risk Assessment (BERA) at SWMU 336, none of the 75 chemicals identified as ecological COPCs are recommended for further evaluation. Surface soils at the SWMU are not indicated to pose unacceptable risks to ecological receptors and no further evaluation is recommended.

No aquatic habitat was present at SWMU 336. The groundwater exposure pathway was evaluated to determine if there was the potential for off-site risk to aquatic receptors via the discharge of contaminated groundwater from the site. This pathway was determined to be incomplete; therefore, no unacceptable ecological risk to aquatic habitat is posed by the SWMU.

Future actions with respect to groundwater are recommended because PCE detected in samples from the temporary monitoring wells were above the North Carolina 2L Standards. These actions

may include installing monitoring wells in locations where sample numbers SWMU336-TW01, SWMU336-TW03 and SWMU336-TW06 were collected and resampling the groundwater in the vicinity of these samples. If the PCE detections are duplicated, then additional monitoring wells could be installed in a manner that would promote long-term monitoring at this site. If the PCE detections are not duplicated, then a third sample could be collected from the monitoring wells and no further action should be implemented at the site if the most recent results indicate that the PCE detections can not be duplicated.

1.0 INTRODUCTION

This report presents the investigation procedures and results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Solid Waste Management Unit (SWMU) 336 (the SWMU) at Marine Corps Base (MCB) Camp Lejeune, North Carolina (the Base). The SWMU location at the Base is depicted on Figure 1-1. This report has been prepared by Baker Environmental, Inc. (Baker) under Contract Task Order (CTO) 0091 of the Department of the Navy's (DoN's) Comprehensive Long-Term Environmental Action Navy (CLEAN) Program. Baker was subcontracted to CH2M Hill for implementation of this project.

1.1 Regulatory History

The Base was issued a RCRA Part B Permit to operate a hazardous waste container storage facility in September 1984. This permit was issued before enactment of the Hazardous and Solid Waste Amendments of 1984 (HSWA), which under Section 3004(u) empowers the United States Environmental Protection Agency (USEPA) to order corrective action at treatment, storage, and disposal (TSD) facilities. This section of the HSWA requires corrective action to be taken for all releases of hazardous waste or hazardous constituents from any SWMU. As a result, a revised Hazardous Waste Management Permit was issued on January 10, 1997 and included corrective actions for SWMUs.

The USEPA Region IV and the North Carolina Department of Environment and Natural Resources (NC DENR) conducted an initial RCRA Facility Assessment (RFA) at the Base in January 1989. The RFA included 76 SWMUs. Seven of the SWMUs required confirmatory sampling; 23 of the SWMUs required an RFI; 46 of the SWMUs required no further action. The initial RFA was later expanded to include units such as landfills, surface impoundments, waste piles, tanks, container storage areas, septic tanks, drain fields, waste treatment units, and storm water conveyances. More than 3,500 SWMUs were identified during a preliminary review of Base records. Visual site inspections were conducted at nearly 500 of these SWMUs. The findings from the RFA are presented in RCRA Facility Assessment Report for Marine Corps Base, Camp Lejeune, North Carolina (Environmental Safety and Design, Inc. [EnSafe], 1996).

The 1996 RFA Report identified 41 Installation Restoration (IR) Program sites, 112 underground storage tank (UST) sites, and 56 SWMUs that required confirmatory sampling or corrective measures. Based on further negotiations between NC DENR and the Base, 62 SWMUs required confirmatory sampling. The Confirmatory Sampling Investigation (CSI) was completed in two phases. Phase I was conducted by Baker in 1997 and included a soil investigation in the vicinity of these 62 SWMUs. Phase II was conducted by Baker in 2002 and 2003 and included additional soil sampling and a groundwater investigation at 41 of the SWMUs that warranted additional investigation at the conclusion of Phase I. In addition, six new SWMUs were included in the Phase II CSI thus increasing the number of SWMUs to 47. Of these 47 SWMUs, it was recommended that 30 SWMUs required no further action, five SWMUs required interim measures, one SWMU required an RFI/interim measures, and 11 SWMUs required RFIs. SWMU 336 was one of the SWMUs requiring a RFI. The findings from the Phase I and II CSIs are presented in the Phase I Confirmatory Sampling Report (Baker, 2001) and Final Phase II Confirmatory Sampling Report (Baker, 2005).

1.2 SWMU Description and History

SWMU 336 consists of a former paint stripping vat located in a separate room within Building AS-4106 at MCAS New River. The vat included one tank for methylene chloride and another vat of rinse water. The floor beneath the vats is concrete with two floor drains located on either side

of the vats. A spill kit is located near the exit doors. Spills that occur at this SWMU are properly contained and cleaned up, according to Base personnel.

Sediment samples were proposed to be collected from the floor drains as part of the Phase I CSIs that were conducted in September 1997. The purpose of the sediment sampling was to determine if a release(s) occurred at the SWMU because the contaminated material would most likely exit the SWMU via the floor drains. However, the floor drains contained no sediment that could be sampled.

A new stripping vat was installed in 1999 and was upgraded to a larger unit in 2004. The new vat is an automated system and uses solvents less harmful to the environment. Solvents considered less harmful include cleaners and patented strippers without phenol, chrome, methanol, toluene, methylene chloride or hazardous pollutants of any kind. This system has greatly reduced the amount of hazardous waste generated and reduced the potential exposure to personnel at the SWMU.

The Phase II CSI (Baker, 2005) was conducted in March/April 2002. Additional samples were collected during a supplemental Phase II investigation conducted in June/July 2003. The purpose of the CSI was to evaluate potential impacts to soil and groundwater in the vicinity of the SWMU. The field investigations included the following:

- Soil sampling at six temporary well borings advanced within the vicinity of the drain lines exiting the room with the paint stripping vats
- Groundwater sampling at six temporary wells

The soil and groundwater samples were submitted to the laboratory and analyzed for VOCs, SVOCs, and RCRA metals. Based on evaluation of the results, one VOC (methylene chloride) and one metal (cadmium) were detected in soil at concentrations exceeding the screening values. The isolated and limited extent of methylene chloride and cadmium suggest that neither constituent represents a confirmed release from the SWMU, nor do they represent a significant impact to soil. The detection of tetrachloroethene (PCE) in groundwater at concentrations exceeding the screening value indicated that additional investigation would be warranted in order to understand the extent of impact on the groundwater in the vicinity of the SWMU. Therefore, a RFI was recommended to adequately characterize the SWMU and determine the potential for future corrective action (if any) based on risks to human health and the environment.

1.3 Purpose/Objectives

The primary goals of this RFI were to adequately characterize the SWMU, and to determine the potential for future corrective action (if any) based on risks to human health and the environment. Specifically, the field information generated during the RFI was used to meet the following objectives:

- Supplement and/or verify the environmental setting at the SWMU, including hydrogeology, geology, hydrology, topography, aquifer characteristics, and any other anthropogenic influences that may affect the hydrology or contaminant pathways at the SWMU.
- Characterize the source of contamination through collection of analytical data, and evaluate the migration and dispersal characteristics of the contamination.

- Characterize the extent, origin, direction, and rate of movement of contamination through collection of soil and groundwater samples in the vicinity of the SWMU.
- Evaluate potential receptors by collecting data describing human populations and environmental systems susceptible to contaminant exposure.
- Evaluate the risk of any contaminants associated with the SWMU to human health and the environment.
- Provide recommendations for site management.

1.4 References

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FIGURES

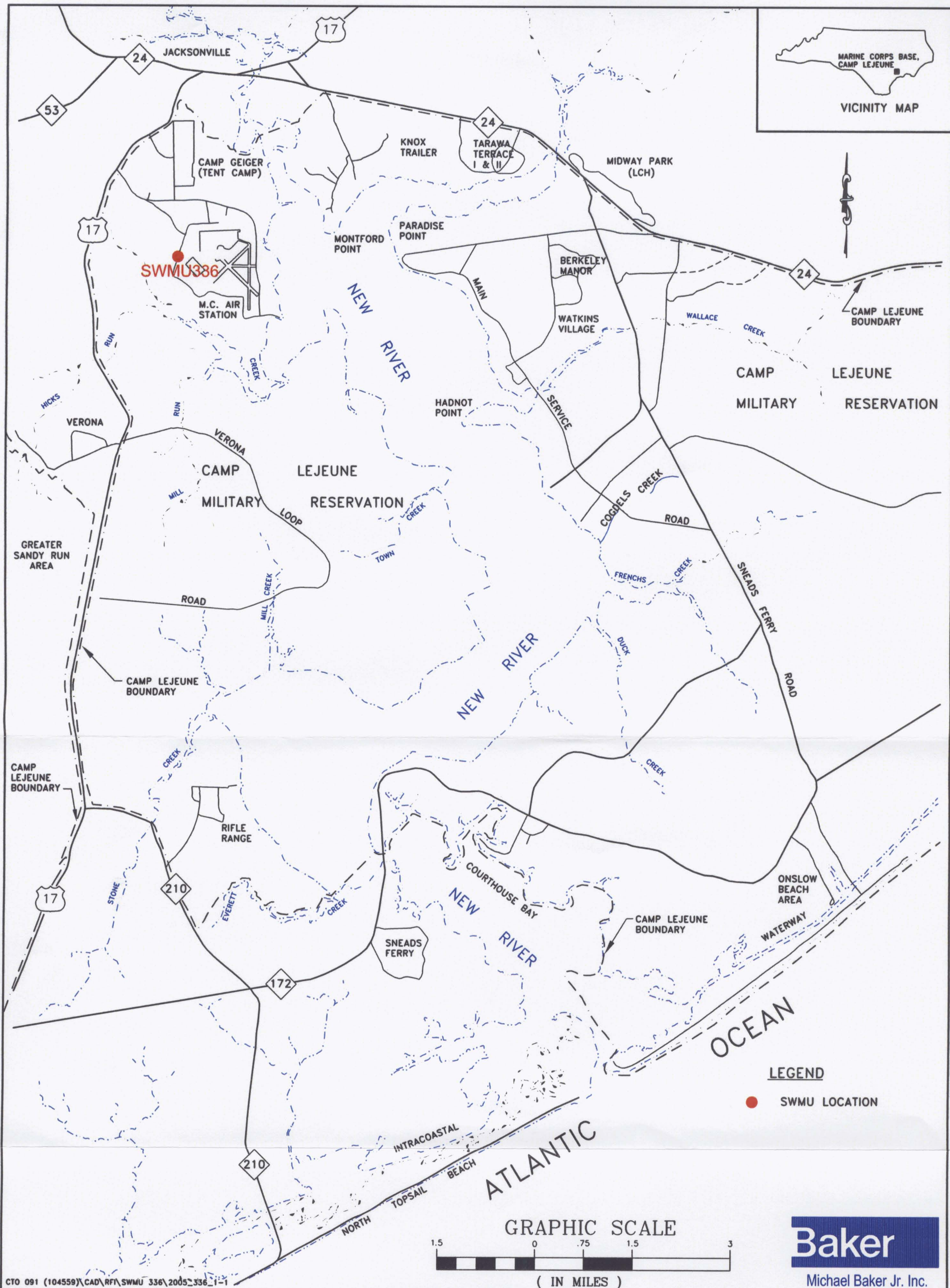


FIGURE 1-1
 GENERAL SITE LOCATION MAP
 RCRA FACILITY INVESTIGATION (RFI)
 SWMU 336
 CTO - 0091
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA

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2.0 FIELD INVESTIGATION

The field investigation for the RFI was conducted by Baker in January and February, 2005 and included the following tasks:

- Surface and Subsurface Soil Sampling
- Groundwater Grab Sampling
- Piezometer Installation
- Field Quality Assurance/Quality Control (QA/QC)
- Laboratory Analytical Program
- Investigation Derived Waste (IDW) Handling
- Site Survey

The following sections present a general overview of the investigation procedures; detailed investigation procedures are presented in the Site-Specific Work Plans for SWMUs 303/318 and 336 (Baker, 2005) and Master Project Plans (Baker, 2003) for the RCRA Program. A summary of the sampling and analytical program is presented on Table 2-1. The soil boring and groundwater grab locations are shown on Figure 2-1.

2.1 Surface and Subsurface Soil Sampling

Surface and subsurface soil samples were collected from 4 borings. These borings were placed surrounding the SWMU and temporary well boring locations (Figure 2-1) from the CSI. Fifteen soil borings were proposed at SWMU 336. However, based on results from the on-site mobile lab, eleven of the proposed borings were eliminated because they were not deemed necessary to delineate soil contamination.

A single soil boring (SWMU336-SB01) was advanced to determine the depth of the Belgrade semi-confining unit and to determine the depth for the groundwater grab samples. Based on the geology encountered in this boring, the Belgrade semi-confining unit was encountered at approximately 25 feet bgs

Each boring was advanced to the water table (approximately 8 feet bgs) using a truck-mounted drill rig and direct push methods. Soil samples were collected continuously in 4-foot increments using a Geoprobe® MacroCore sampler and field screened for total volatile organic vapors using a photoionization detector (PID). Soils were classified in the field as they were encountered. Soil descriptions, including estimates of grain size, relative density, moisture content, coloration, odor, and other visual observations were recorded in the field logbook and on Test Boring and Piezometer Construction Records (Appendix A).

Three soil samples from each boring were selected for chemical analyses based on sample depth, lithologic location, and/or field observations indicative of contamination (e.g., elevated PID readings, discoloration, etc.). If no evidence of contamination was observed, then the default sample depths were at the surface or just below the concrete/subbase, at the soil/groundwater interface, and half way between the surface and the soil/groundwater interface. The samples were placed into appropriate, laboratory-supplied sample containers and analyzed in the field for VOCs in a mobile laboratory using gas chromatograph/mass spectroscopy (GC/MS) methods. Approximately 10 percent of the samples were submitted to a fixed-base laboratory and analyzed for TCL VOCs to confirm the mobile laboratory data and provide comparative data. In addition, one sample from each boring was submitted to the fixed-base laboratory and analyzed for RCRA metals. Subsequent to sampling, the borings were backfilled with bentonite.

2.2 Groundwater Grab Sampling

Groundwater grab samples were collected from six borings and analyzed for VOCs in an attempt to determine the extent of contamination. Groundwater contamination was not found in any of the six locations. Fifteen borings were originally proposed in the work plans to delineate the groundwater contamination. Based on the results from the mobile lab, nine of these groundwater grab locations were eliminated.

As stipulated in the work plans, two groundwater grab samples were collected from each boring within the following specified depths:

- Near the upper portion of the surficial aquifer 12 to 16 feet bgs
- Within the deeper portion of the surficial aquifer above/within the Belgrade semi-confining unit 22 to 26 feet bgs

The groundwater grab samples were collected using a 4-foot long, stainless steel, discrete sampler that was hydraulically pushed to the desired depth. The cover of the sampler was then retracted, thus allowing groundwater to flow into the device for sampling. The samples were retrieved using a peristaltic pump and new tubing for each sample. Prior to sample collection, groundwater was purged from the borehole for several minutes to reduce the turbidity to the extent practical. The samples were placed into appropriate, laboratory-supplied sample containers and analyzed in the field for VOCs using a mobile laboratory and GC/MS methods. Approximately 10 percent of the samples were submitted to a fixed-base laboratory and analyzed for TCL VOCs to confirm the mobile laboratory data and provide comparative data. Subsequent to sampling, the borings were backfilled with bentonite.

2.3 Piezometer Installation

Analytical results from the mobile lab did not indicate any VOC concentrations exceeding the North Carolina 2L Standards in the twelve groundwater grab samples collected. Since it appeared that minimal environmental impact to groundwater had occurred in the vicinity of the SWMU, the groundwater monitoring wells originally proposed in the work plans were eliminated. A request was made to NC DENR to allow us to eliminate these wells in an email and acceptance was received in the same format on February 16, 2005.

In order to confirm the groundwater flow direction, piezometers were installed at groundwater grab locations SWMU336-GW01, SWMU336-GW08, and SWMU336-GW10 (see Figure 2-1). The construction details for the temporary wells installed during the Phase II CSI and the piezometers installed during this RFI are presented in Table 2-2. Water level measurements collected in the field are also included in Table 2-2.

The piezometers were installed using Geoprobe® direct push methods. A Geoprobe® Macrocore was driven to approximately 18 feet bgs. The macrocore was extracted leaving an open borehole. The piezometers were constructed, as directed by the on-site geologist, using 1-inch ID, Schedule 40, polyvinyl chloride (PVC) well casing and screen materials. Well screens used for the piezometer construction were 10-foot long with a slot size of 0.010 inches. The annular space around the well screen was backfilled with well-graded, fine sand. The sand was extended to approximately 2 feet above the top of the screened interval. A bentonite seal was placed above the sand pack and hydrated with potable water, as necessary. After the groundwater levels were

collected and the survey was completed, all three piezometers were abandoned and backfilled with bentonite on February 19, 2005.

2.4 Field Quality Assurance/Quality Control

Field QA/QC samples included three trip blanks; two equipment rinsate blanks, and three field blanks. Field duplicate samples and matrix spike/matrix spike duplicates (MS/MSD) were collected at a frequency of 10% and 20%, respectively. Table 2-1 provides a summary of QA/QC samples collected, as well as sources of equipment rinsate and field blanks.

Trip blanks were samples of analyte-free water prepared at the laboratory before commencement of the sampling event and shipped to the sampling team along with the unopened sample containers. The trip blanks were then randomly selected and included in each cooler containing samples for volatile organics analysis. The results were evaluated by the data validator to verify that the sample containers and method of sample container handling used throughout the sampling program have not contributed to contamination of the samples. In addition, the results were used to identify other potential sources of field or laboratory contamination.

Equipment rinsate blanks were collected by running laboratory-grade, deionized water over/through the sampling equipment and placing it into the appropriate sample containers for laboratory analyses. The results were evaluated by the data validator to verify that the sampling equipment has not contributed to contamination of the samples. Equipment rinsates were collected as follows:

- ER01-020205 – Collected from dedicated polyethylene tubing used for groundwater sampling;
- ER02-020405 – Collected from an acetate sleeve used in the macro core sampler;

One field blank was collected from sources of water used during each phase in the decontamination process. The field blanks were collected by pouring water from the original source directly into the sample bottle set. The results were evaluated by the data validator to verify that the water used in decontamination has not contributed to contamination of the samples. In addition, the results were used to identify other potential sources of field or laboratory contamination. Sources of water sampled include the potable water source located at the wash pad, the distilled water purchased from Foodlion, and the deionized water provided by the laboratory for use in the equipment blanks.

Field duplicate samples consisted of one unique sample, split into two aliquots, and analyzed independently for the same parameters as the corresponding original samples. The duplicate soil sample was homogenized and split. The duplicate water sample was collected simultaneously. The results were evaluated by the data validator to verify the reproducibility of the laboratory results and degree of variability of reported concentrations. Duplicates samples were collected for both the mobile laboratory and fixed-based laboratory. The analytical results for these samples are summarized in tables included in Appendix D.

MS/MSD samples were prepared in the field using the same procedures as duplicate samples and analyzed for the same parameters as the corresponding original samples. The results were evaluated by the data validator to address aliquoting reproducibility and to provide information on matrix reproducibility otherwise unobtainable from samples reported below analytically reproducible and statistically valid levels. MS/MSD samples were collected for both the mobile

laboratory and fixed-based laboratory. The analytical results for these samples are summarized in tables included in Appendix D.

2.5 Laboratory Analytical Program

Soil and groundwater grab samples were analyzed in the field by New Age/Landmark Mobile Laboratory Services located in Benton Harbor, Michigan. These samples were analyzed for TCL VOCs using Solid Waste (SW) 846 Method 8260B.

As indicated in Sections 2.1 and 2.2, approximately 10 percent of the samples collected for on-site analysis were submitted to a fixed-base laboratory for confirmation. These samples were stored on ice in coolers at approximately 4 degrees Celsius (or less) and delivered by Federal Express to Katahdin Analytical Services, Inc. Chain-of-Custody Forms were completed and enclosed in the shipping packages. These samples were analyzed for one or more of the following analytical suites in accordance with the USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) or SW846 Methods:

- TCL VOCs using Organic Low Medium (OLM) 04.2/04.3
- RCRA Metals using Inorganic Low Medium (ILM) 04.1/6010B/7470A

Copies of the Chain-of-Custodies are included in Appendix B of this report.

2.6 Investigation Derived Waste Handling

IDW included potentially contaminated soil, groundwater, decontamination fluids, personal protective equipment (i.e., gloves and other health and safety disposables), and general trash. Soil cuttings/excess soil samples were containerized in Department of Transportation (DOT) approved 55-gallon drums. Groundwater/decontamination fluids were containerized in a poly-tank. The drums and poly-tank were staged in a designated area at SWMU 303/318 pending final disposition. Personal protective equipment and general trash were placed in garbage bags and disposed of in Baker's regular trash dumpster located by at Lot 203.

The soil and water IDW were sampled and disposed of by the Remedial Action Contractor (RAC) (Shaw Environmental & Infrastructure, Inc).

2.7 Site Survey

The sample locations were surveyed by Baker for horizontal position within the North Carolina State Plane Coordinate System using mapping-grade global positioning system (GPS) equipment (Trimble Pro XRS with a TSCE Data Collector). The horizontal accuracy was within approximately 3 feet.

All sample locations and piezometers were surveyed by Lanier Surveying of Jacksonville, North Carolina for topographic elevation relative to mean sea level (msl) and horizontal position within the North Carolina State Plane Coordinate System. The vertical accuracy of the survey was within 0.01 feet and the horizontal accuracy was within 0.1 feet.

2.8 References

Baker, 2005

Baker Environmental, Inc. Site-Specific Work Plans for SWMUs 303/318 and 336. RCRA Program, Marine Corps Base Camp Lejeune.

Final. Prepared for the Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. January 2005.

Baker, 2003

Baker Environmental, Inc. Master Project Plans. RCRA Program, Marine Corps Base Camp Lejeune. Final. Prepared for the Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. March 2003.

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TABLES

TABLE 2-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Soil Boring/ Monitoring Well Designation			Mobile Laboratory	Fixed-Base Laboratory			
			Soil and Groundwater	Soil and Groundwater			
	Date	Depth (feet bgs)	TCL VOCs	TCL VOCs	RCRA Metals	Total Organic Carbon	Total Oxidant Demand
GEOPROBE SOIL BORINGS							
SWMU336-SB01-00	2/1/2005	0 - 1	1	1	1		
SWMU336-SB01-02	2/1/2005	3 - 5	1				
SWMU336-SB01-04	2/1/2005	7 - 9	1				
SWMU336-SB04-00	2/1/2005	0 - 1	1				
SWMU336-SB04-02	2/1/2005	3 - 5	1	1	1		
SWMU336-SB04-04	2/1/2005	7 - 9	1				
SWMU336-SB05-00	2/1/2005	0 - 1	1				
SWMU336-SB05-02	2/1/2005	3 - 5	1		1		
SWMU336-SB05-05	2/1/2005	9 - 11	1				
SWMU336-SB09-00	2/2/2005	0 - 1	1				
SWMU336-SB09-03	2/2/2005	5 - 7	1				
SWMU336-SB09-03D	2/2/2005	5 - 7	1				
SWMU336-SB09-06	2/2/2005	17 - 19	1		1		
GROUNDWATER GRAB SAMPLES							
SWMU336-GW01	2/1/2005	12 - 16	1				
SWMU336-GW01-01	2/1/2005	22 - 26	1				
SWMU336-GW04	2/1/2005	12 - 16	1				
SWMU336-GW04-01	2/1/2005	22 - 26	1	1			
SWMU336-GW05	2/1/2005	12 - 16	1				
SWMU336-GW05-01	2/1/2005	22 - 26	1				
SWMU336-GW08	2/4/2005	12 - 16	1				
SWMU336-GW08-01	2/4/2005	22 - 26	1				
SWMU336-GW08-01D	2/4/2005	22 - 26	1				
SWMU336-GW09	2/2/2005	12 - 16	1				
SWMU336-GW09-01	2/2/2005	24 - 26	1	1			
SWMU336-GW10	2/4/2005	12 - 16	1				
SWMU336-GW10D	2/4/2005	12 - 16	1				
SWMU336-GW10-01	2/4/2005	22 - 26	1				
EQUIPMENT RINSATES			COMMENTS				
ER01-020205	2/2/2005	NA	Tubing	X			
ER02-020405	2/4/2005	NA	Sleeve	X	X		
TRIPBLANKS							
TB01	2/1/2005	NA		X			
TB02-020205	2/2/2005	NA		X			
TB03-020405	2/4/2005	NA		X			
FIELD BLANKS							
FB01-05A	2/18/2005	NA	Lab water	X	X		
FB02-05A	2/18/2005	NA	DI - Foodlion	X	X		
FB03-05A	2/18/2005	NA	Wash Pad	X	X		

Notes:

bgs - below ground surface

VOC - Volatile Organic Compound

WELL/PIEZOMETER CONSTRUCTION DETAILS AND WATER LEVEL MEASUREMENTS

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

Well No.	Date Installed	Consultant Supervising Well Installation	Top of PVC Casing Elevation (feet, above msl)	Ground Surface Elevation (feet, above msl)	Boring Depth (feet, bgs)	Well Depth (feet, bgs)	Depth to Sand Pack (feet, bgs)	Depth to Bentonite (feet, bgs)	Screen Interval Depth (feet, bgs)	Depth to Groundwater (feet, below top of casing)	Groundwater Elevation (feet, bgs)
SWMU336-TW01	3/20/2002	BAKER	24.04	24.1	16	16	3	1	5	11.70	12.34
SWMU336-TW02	3/20/2002	BAKER	24.30	24.4	15	15	3	1	5	11.60	12.70
SWMU336-TW03	6/23/2003	BAKER	26.59	N/A	12	18	6	5	8	12.56	14.03
SWMU336-TW04	6/23/2003	BAKER	23.42	N/A	12	16	4	3	6	9.42	14.00
SWMU336-TW05	6/23/2003	BAKER	26.42	N/A	12	17	5	4	7	12.56	13.86
SWMU336-TW06	6/23/2003	BAKER	27.09	N/A	16	17	5.5	4	7	13.17	13.92
SWMU336-PZ01	2/18/2005	BAKER	21.94	N/A	18	18	6	1	8	9.69	12.25
SWMU336-PZ08	2/18/2005	BAKER	24.22	N/A	18	18	6	1	8	12.44	11.78
SWMU336-PZ10	2/18/2005	BAKER	23.64	N/A	16	16	4	1	6	11.32	12.32

Notes:

msl = Mean Sea Level

bgs = Below Ground Surface

N/A = Not Applicable

PVC = Polyvinyl chloride

Depth to groundwater for piezometers as measured on February 18, 2005

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FIGURES

3.0 PHYSICAL CHARACTERISTICS

A sufficient understanding of the nature and extent of contamination as well as fate and transport of those constituents requires an understanding of the physical environment context in which the contamination occurs. The subsections that follow present information to support an interpretation of the physical environment, including topography and surface hydrology, potable water supply, and geology and hydrogeology from a regional and SWMU-specific perspective.

3.1 Topography and Surface Hydrology

SWMU 336 (the paint stripper) is located inside Building AS-4106, on the northwest side of the building. The overall topography in the vicinity of the study area is flat to gently sloping. The surface elevation at White Street is approximately 24-feet above msl. The surface elevation of the asphalt storage area, to the northwest of AS-4106, is approximately 23.4-feet above msl. A concrete drainage channel designed to convey surface water runoff is located northwest of the SWMU and southeast of White Street.

Surface water flow across the study area is controlled. Due to the developed nature of the study area, rainwater runoff is collected in roof gutters, storm water sewer inlets in parking/storage areas, and in drainage ways along roads. Direct infiltration occurs in the limited grassy areas found along side building AS-4106. During heavy rain events, it is assumed that all surface water flows to the storm water system.

3.2 Potable Water Supply

Information concerning the potable water supply at the Base was derived from the Wellhead Protection Plan – 2002 Update (AH Environmental Consultants [AH], 2002), interviews with Base personnel, and other literature sources referenced herein. Potable water for the Base is derived entirely by groundwater. The Base does not have established groundwater preservation areas. However, because the Base controls more than 236 square miles of land, and because much of this land has remained undeveloped, the undeveloped areas serve the function of groundwater preserves. Groundwater usage is roughly eight million gallons per day (gpd) (Cardinell, et al., 1993). Groundwater is pumped from approximately 84 water supply wells located within the boundaries of the Base. According to Base personnel, groundwater is treated at five plants located at Hadnot Point, Holcomb Boulevard, MCAS New River, Courthouse Bay, and Onslow Beach. The treatment plants have a maximum total capacity of 15.8 million gpd. However, at this time the Base population only requires 6.5 million gpd.

The water supply wells at the Base withdraw water from the Castle Hayne aquifer. The Castle Hayne aquifer is a highly permeable, semi-confined aquifer that can yield several hundred to 1,000 gallons per minute (gpm). The water supply wells, typically 8-inches in diameter, average 162 feet in depth and yield 174 gpm (Harned, et al., 1989). The water is typically a hard, calcium bicarbonate type.

Figure 3-1 shows the SWMU in relation to nearby water supply wells. The nearest active water supply well (PSWAS-4150) is located approximately 1250-feet hydraulically side-gradient of the SWMU. Based on information presented in the Wellhead Protection Plan, the average pumping capture zone (10 year) around well PSWAS-4150 is approximately 300 feet. The maximum pumping capture zone (10 year) around well PSWAS-4150 is approximately 1000 feet. Thus, with the distance from the SWMU, and because the well is side-gradient of the SWMU, it is

improbable that any release from the study area would impact well PSWHP-4150. This scenario will be addressed in the fate and transport section of this report.

3.3 Geologic and Hydrogeologic Framework

Site-specific geologic and hydrogeologic information was obtained from soil borings and monitoring wells drilled at the SWMU. In addition, available geologic publications and mapping were reviewed. This information is discussed in context of the regional framework presented below.

3.3.1 Regional Framework

The Base is located within the Tidewater region of the Atlantic Coastal Plain physiographic province. The sediments of the Atlantic Coastal Plain consist mostly of interbedded sands, silts, clays, calcareous clays, shell beds, sandstone, and limestone. These sediments are layered in interfingering beds and lenses that gently dip and thicken to the southeast to a combined thickness of approximately 1,500 feet. The sediments were deposited in marine or near-shore environments and range in age from early Cretaceous to Quaternary time. Regionally, the sediments comprise 10 aquifers and nine confining units, which overlie igneous and metamorphic basement rocks of the pre-Cretaceous age. Seven of these aquifers and their associated confining units are present at the Base (Cardinell, et al., 1993). Table 3-1 presents a generalized stratigraphic column for Jones and Onslow Counties, North Carolina. A hydrogeologic section location plan and hydrogeologic cross-sections of the Base are presented in the Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina (Cardinell, et al, 1993).

United States Geological Survey (USGS) studies performed by Harned, et al., 1989 and Cardinell, et al., 1993 indicate that the Base is underlain by sand and limestone aquifers separated by confining units of silt and clay. These aquifers include the surficial (water table), Castle Hayne, Beaufort, Pee Dee, Black Creek, and upper and lower Cape Fear. Less permeable clay and silt beds function as confining units or semi-confining units that separate the aquifers and impede the flow of groundwater between aquifers.

Historically, only the upper two aquifers have been impacted by Base activity, namely the surficial aquifer and the Castle Hayne aquifer. The surficial unit consists of interfingering beds of sand, clay, sandy clay, and silt that contain some peat and shells in the undifferentiated formation. According to information presented by the USGS, the undifferentiated formation/surficial aquifer is approximately 15 to 25 feet thick in the vicinity of the Hadnot Point industrial area. Although this aquifer is classified as GA (i.e., existing or a potential source of drinking water supply for humans), it is not used as a potable water source at the Base because of its low yielding production rates (typically less than 3 gpm). The Belgrade formation consists of clay, sandy clay, and silt beds and is part of the Castle Hayne confining unit. Practically though, the Belgrade formation tends to be semi-confining in nature because it is laterally discontinuous. The thickness of this unit ranges from approximately 0 to 26 feet and typically averages 9 feet where present, with no discernible thickness trend. The Castle Hayne aquifer primarily resides within the River Bend Formation, which consists of sand, cemented shells, and limestone. The upper portion of the aquifer primarily consists of calcareous sands with some thin clay and silt beds. The sand becomes increasingly more limy with depth. The lower portion of the aquifer consists of partially unconsolidated limestone and sandy limestone interbedded with clay and sand. In addition, buried paleostream channels containing various deposits exist within the aquifer. According to information presented by the USGS, the Castle Hayne aquifer is approximately 350 feet thick in the vicinity of the Hadnot Point industrial area.

Recharge to the surficial aquifer is by rainfall. The aquifer receives more recharge in the winter than in the summer when much of the water evaporates or is transpired by plants before it can reach the water table. Most of the surficial groundwater is discharged to local streams, but some water passes through the underlying semi-confining unit. Recharge is estimated to average 30 percent of an average rainfall of 52 inches per year. The remaining 70 percent of rainfall is lost as surface runoff or evapotranspiration. Water levels in wells tapping the surficial aquifer vary seasonally. The water table is generally highest in the winter and spring, and lowest in the summer and early fall. Recharge of the Castle Hayne aquifer at the Base is primarily received from the surficial aquifer. Natural discharge is to the New River and its major tributaries. Although the Castle Hayne aquifer provides approximately seven million gallons of water to the Base, groundwater pumping has not significantly affected natural head gradients in the aquifer.

Hydraulic conductivities of the surficial and Castle Hayne aquifers have been estimated through various studies and have been found to vary significantly from study to study as well as spatially. The estimated lateral hydraulic conductivity for the surficial aquifer is 50 feet per day (ft/d) and is based on a general composition of fine sand mixed with some silt and clay (Cardinal, et al., 1993). Baker compiled and studied data from aquifer pumping tests at the Base in 1994 to evaluate aquifer characteristics and production capacities. The technical memorandum is provided as Appendix E. The information contained in this memorandum pertains primarily to the surficial aquifer. Average pumping rates were established between 0.5 to 3 gpm, with a hydraulic conductivity estimate range from 0.5 to 1.4 ft/d. Estimated hydraulic conductivity values of the Castle Hayne aquifer range from 14 to 91 ft/d.

3.3.2 Site-Specific Framework

Geology

Two cross sections were prepared for the SWMU 336 RFI report to represent subsurface geology (Figure 3-2). Cross Section A-A' begins at soil boring SWMU336-SB01 and traverses to the southeast, to soil boring location SWMU336-SB09 (Figure 3-3). Cross Section B-B' begins at soil boring SWMU336-GW04 and traverses to the northeast, to boring SWMU336-GW05 (Figure 3-4). The paragraphs that follow discuss the cross section geology (Figures 3-3 and 3-4).

The subsurface geology in the vicinity of SWMU 336 exhibits a fairly consistent stratigraphic sequence, with some heterogeneity within the stratigraphic layers. Generally, the sequence observed as follows (from shallow to deep):

The undifferentiated formation (0 – 25 feet bgs)

- Fill material (e.g., pavement and sub base)
- Silt and/or clay
- Fine sand, with trace to some silt and/or clay

The Belgrade formation (25 – 27.5 feet bgs)

- Predominantly fine sand with some silt and little clay or predominantly silt

The River Bend formation (below 27.5 feet bgs)

- Shell and fossil fragments (generally fine to coarse sand and/or fine to coarse gravel)

Much of the surface and near surface (typically to a depth of 1.5 feet or less) in the vicinity of the SWMU consists of asphalt or concrete with a sand and gravel filled sub base. Where pavement

and sub base are absent, silt or fine sand was observed. This material appears to be fill at most locations.

A clay and/or silt layer is present immediately below the fill. This was observed in the northwestern part of the study area (e.g., borings SWMU336-GW01, GW04 and GW05). This layer pinches out to the southeast, with evidence from boring SWMU336-GW09. The top of this layer was observed between 1 and 4 feet bgs. This clay/silt layer tends to be approximately 5 to 6 feet thick.

A fine sand layer is present immediately below the clay and/or silt layer across the northwestern portion of the study area. This sand layer appears to be relatively homogeneous for the Base; with trace to little amounts of silt and/or clay. This sand layer is approximately 17 to 26 feet thick, where thicker areas being found where the clay and/or silt layer does not exist in the subsurface.

The base of the sand layer noticeably changes color and composition. This layer is predominantly fine sand, with some silt and little clay, or is predominantly silt, with little to some fine sand. The observed characteristics of this unit are consistent with the Belgrade formation (Cardinell, et al, 1993). This layer typically is encountered approximately 24 to 28 feet bgs and is typically 3 to 5 feet thick.

A unit characterized by the presence of shell and fossil fragments, and calcareous sand is typically about 30 feet bgs, but ranges from 26 to 33 feet bgs. Due to the presence of shell and fossil fragments, this unit has been identified as the River Bend formation and is immediately below the Belgrade formation. According the USGS Report (Cardinell, et al, 1993), this formation can be 500 feet thick in some locations, well below the depth of this investigation.

Hydrogeology

Only the surficial aquifer was examined during this investigation. According to the groundwater measurements collected during the Phase II CSI in June 2003, the groundwater flow direction was calculated to flow southerly. As part of the RFI, three piezometers were installed to confirm the groundwater flow direction observed during the Phase II CSI. Groundwater level measurements were collected from the three piezometers in February 2005 and are presented in Table 2-2. The water table was measured in the wells/piezometers at depths ranging between 9 and 14 feet bgs, with corresponding elevations between 11 and 14 feet above msl. The southern flow direction was confirmed during the RFI and based on review of the geology and groundwater level measurements; the surficial aquifer was determined to be unconfined at the SWMU. An interpretive groundwater contour map for February 2005 is provided as Figure 3-5. A review of this figure indicates that the hydraulic gradient across the site is approximately 0.0017 feet/foot.

No monitoring wells were installed at SWMU 336; therefore no slug testing could be performed. The hydraulic conductivity estimates for the surficial aquifer are assumed to be similar to those estimates calculated during other nearby investigations ranging from 0.3 to 7.4 feet per day (ft/d), with an average of 2.0 ft/d.

Groundwater velocity estimates were calculated using a variation of Darcy's equation and the estimated hydraulic conductivity:

$$V = Ki/n_e$$

where: V = groundwater velocity (ft/d)
 K = hydraulic conductivity (ft/d)
 i = hydraulic gradient (feet/foot)
 n_e = effective porosity (dimension less) and assumed to be on the order of 30 percent

Based on the available data, the approximate groundwater velocity estimate is 0.01 ft/d (3.65 feet/year) for this site. It must be cautioned that this estimate is based on the hydraulic conductivity of nearby SWMU 303/318 RFI data.

Summary

A fairly consistent stratigraphy has been observed at the SWMU. A silt and/or clay layer underlies surficial fill (asphalt/concrete and sub base) in the northwestern portion of the study area and pinches out to the southeast. Slightly heterogeneous fine sand is present below the silt/clay layer, and is the primary water bearing unit of the surficial aquifer. This fine sand typically shows a hydraulic conductivity ranging between 0.3 to 7.4 ft/d. Groundwater velocity has been estimated at 3.65 feet/year in a southern direction. A mostly continuous layer consisting of silt or fine sand, with some silt and little clay underlies the fine sand layer. This unit has been identified as Belgrade formation (Castle Hayne confining unit). Initial indications from other investigation areas suggest that this layer is semi-confining.

3.4 References

- | | |
|-------------------------|--|
| AH, 2002 | <u>AH Environmental Consultants Wellhead Protection Plan – 2002</u>
Prepared for the Naval Facilities Engineering Command, Atlantic Division, Norfolk, Virginia. August 2002. |
| Cardinell, et al., 1993 | <u>Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina</u> USGS. Water-Resources Investigations Report 93-4049. |
| Harned, et al., 1989 | Harned, Douglas A., et al, <u>Assessment of Hydrologic and Hydrogeologic Data at Camp Lejeune Marine Corps Base, North Carolina</u> . U.S. Geological Survey, Water-Resources Investigations Report 89-4096. 1989. |

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TABLES

TABLE 3-1

GEOLOGIC AND HYDROGEOLOGIC UNITS IN THE COASTAL PLAIN OF NORTH CAROLINA
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

GEOLOGIC UNITS			HYDROGEOLOGIC UNITS
System	Series	Formation	Aquifer and Confining Unit
Quaternary	Holocene/Pleistocene	Undifferentiated	Surficial Aquifer
Tertiary	Pliocene	Yorktown Formation ⁽¹⁾	Yorktown Confining Unit
	Miocene	Eastover Formation ⁽¹⁾	Yorktown Aquifer
		Pungo River Formation ⁽¹⁾	Pungo River Confining Unit
			Pungo River Aquifer
		Belgrade Formation ⁽²⁾	Castle Hayne Confining Unit
	Oligocene	River Bend Formation	Castle Hayne Aquifer
	Eocene	Castle Hayne Formation	Beaufort Confining Unit ⁽³⁾
	Palocene	Beaufort Formation	Beaufort Aquifer
Cretaceous	Upper Cretaceous	Peedee Formation	Peedee Confining Unit
			Peedee Aquifer
		Black Creek and Middendorf Formations	Black Creek Confining Unit
			Black Creek Aquifer
	Cape Fear Formation		Upper Cape Fear Confining Unit
			Upper Cape Fear Aquifer
			Lower Cape Fear Confining Unit
			Lower Cape Fear Aquifer
	Lower Cretaceous ⁽¹⁾	Unnamed Deposits ⁽¹⁾	Lower Cretaceous Confining Unit
			Lower Cretaceous Aquifer ⁽¹⁾
Pre-Cretaceous Basement Rocks		---	---

Notes:

⁽¹⁾ Geologic and hydrologic units not present beneath Camp Lejeune.⁽²⁾ Constitutes part of the surficial aquifer and Castle Hayne confining unit in the study area.

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FIGURES

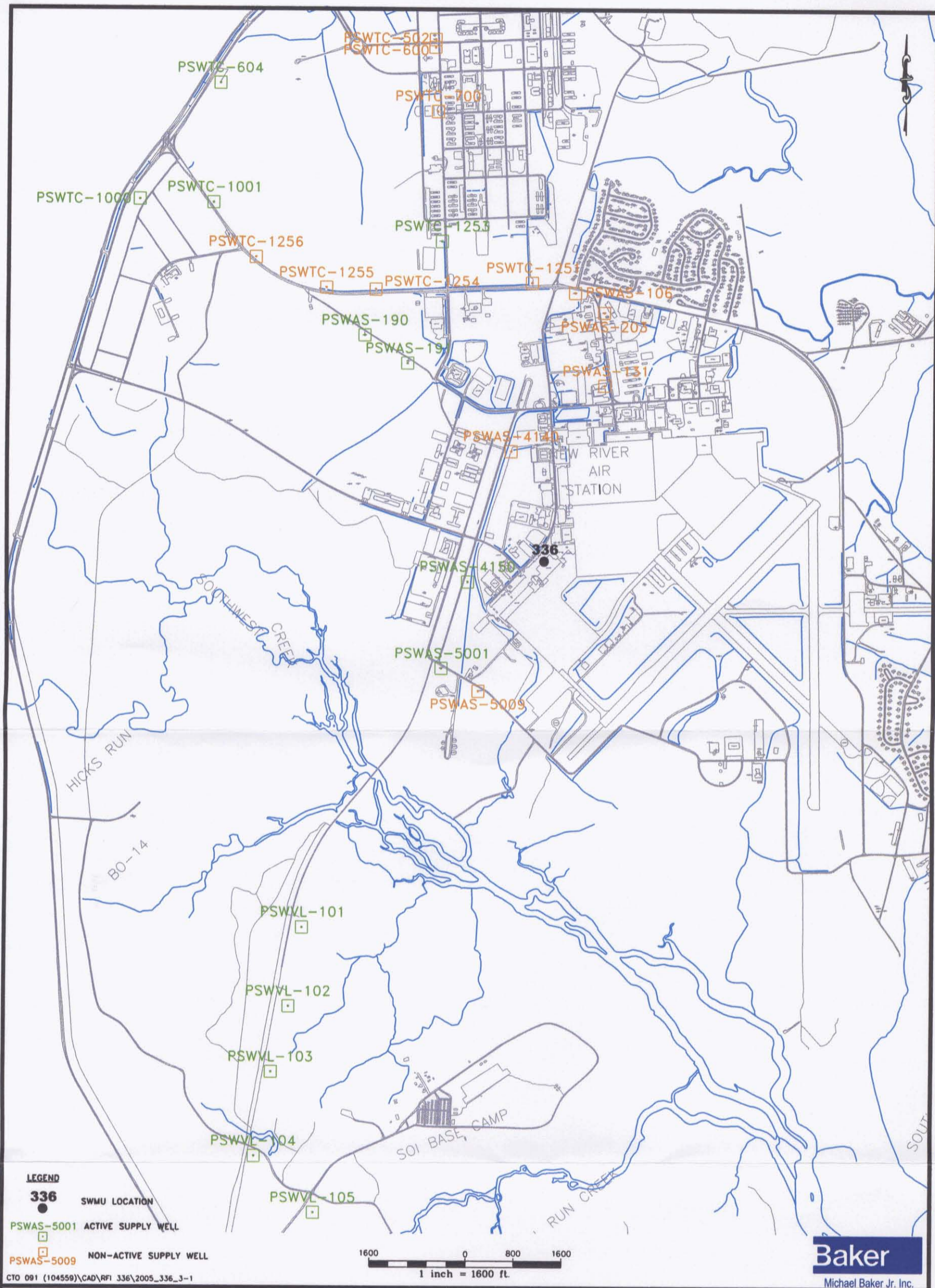
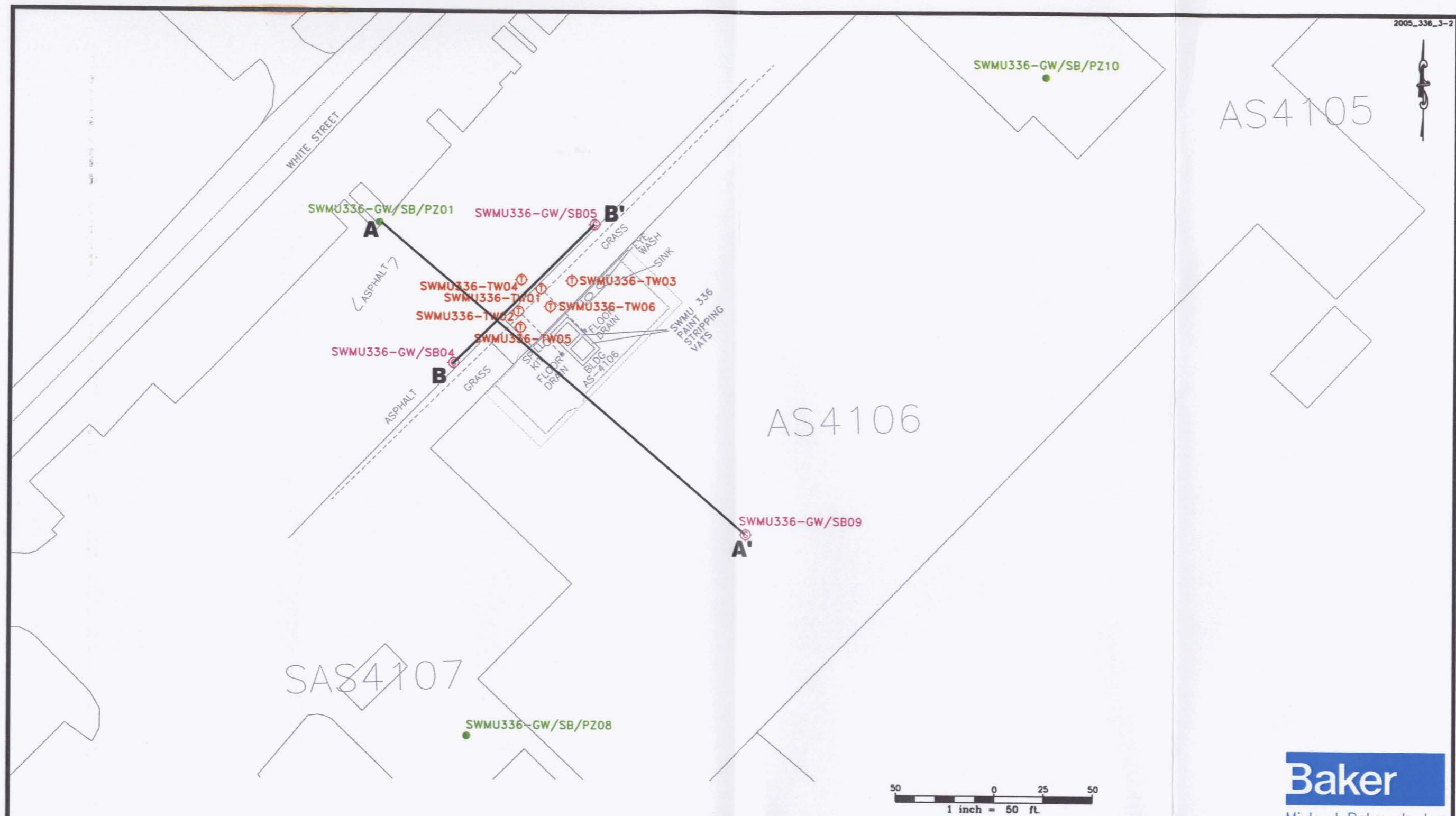


FIGURE 3-1
WATER SUPPLY WELL LOCATION MAP
RCRA FACILITY INVESTIGATION (RFI)
SWMU 336, CTO - 0091

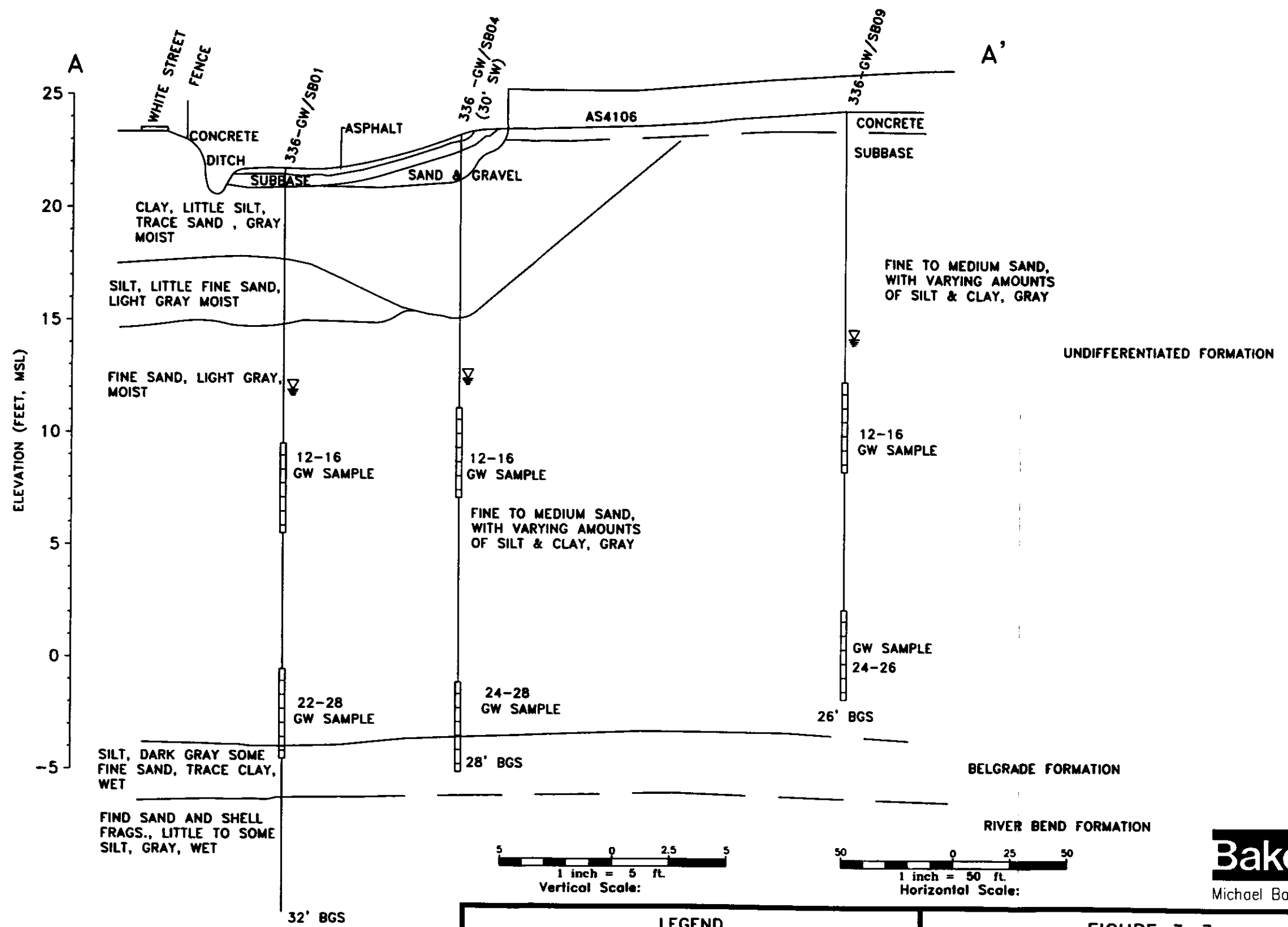
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: MCB CAMP LEJEUNE, MARCH 2000



<p align="center">LEGEND</p> <ul style="list-style-type: none"> - CSI TEMPORARY WELL LOCATION - RFI GROUNDWATER GRAB/SOIL BORING/PIEZOMETER LOCATION - RFI SOIL BORING/GROUNDWATER GRAB LOCATION <p>SOURCE: MCB CAMP LEJEUNE, MARCH 2000</p>	<p align="center">FIGURE 3-2</p> <p align="center">CROSS-SECTION LOCATION MAP</p> <p align="center">RCRA FACILITY INVESTIGATION</p> <p align="center">SWMU 336, CTO-0091</p> <p align="center">MARINE CORPS BASE, CAMP LEJEUNE</p> <p align="center">NORTH CAROLINA</p>
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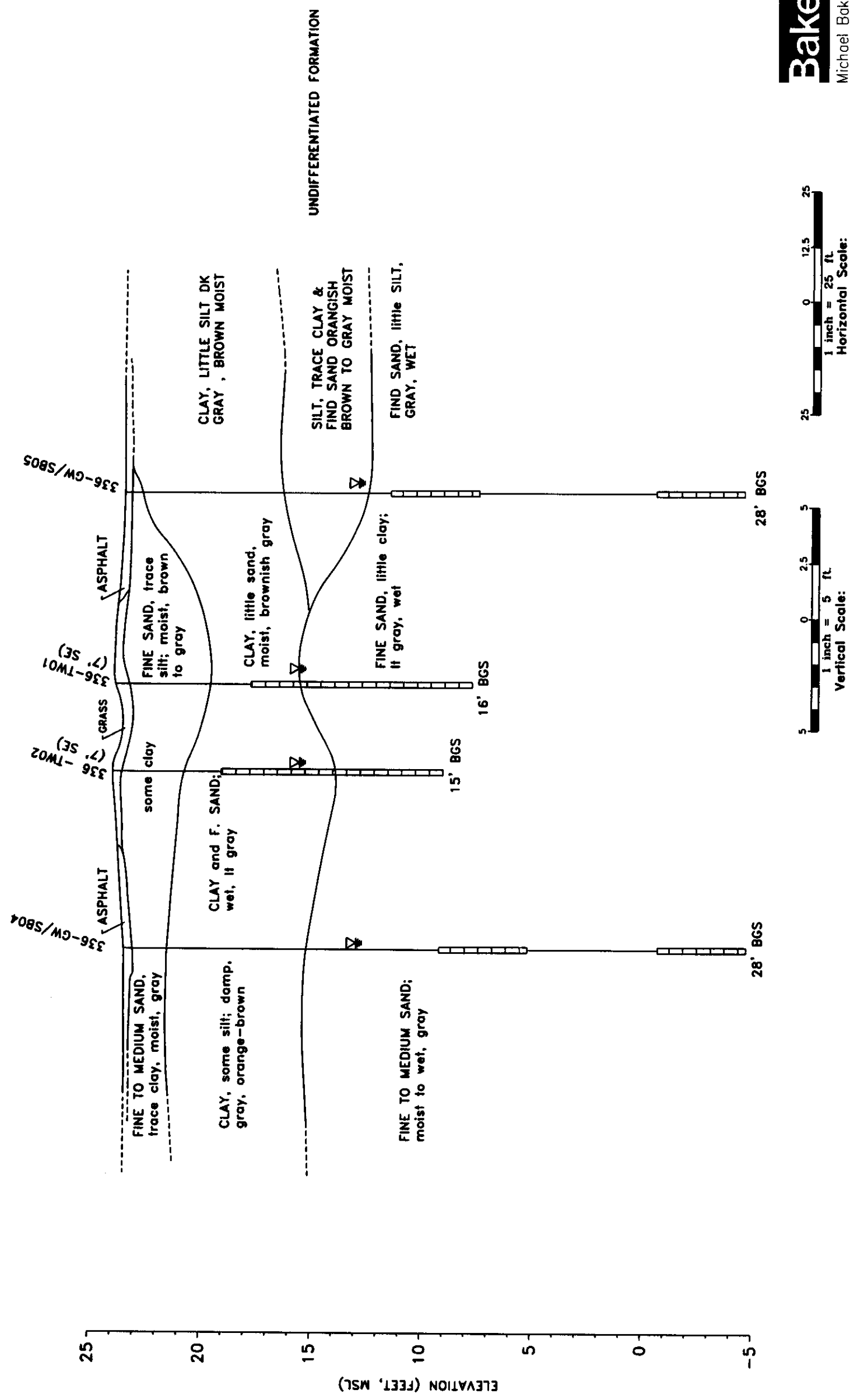
THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

SOURCE: MCB CAMP LEJEUNE, MARCH 2000

LEGEND

- GEOPROBE® SP-15 SCREEN INTERVAL
- ESTIMATED CONTACT
- PROJECTED CONTACT
- GROUNDWATER ENCOUNTERED DURING DRILLING

FIGURE 3-3
CROSS SECTION A TO A'
RCRA FACILITY INVESTIGATION
SWMU 336, CTO-0091
MARINE CORPS BASE, CAMP LEJEUNE
CAMP LEJEUNE, NORTH CAROLINA



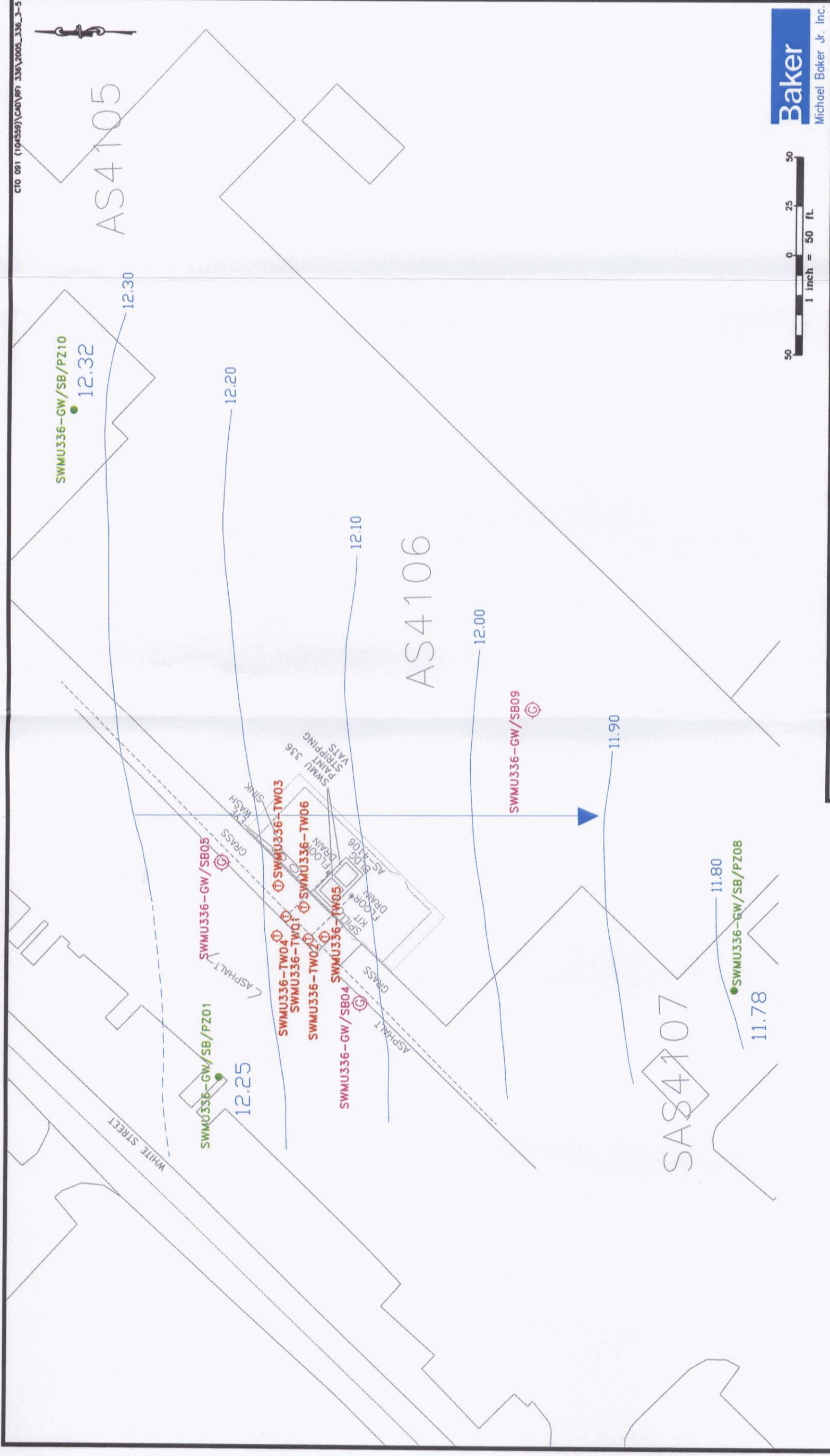
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THE SOIL BORING INFORMATION IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THE RESPECTIVE BORING LOCATIONS. SUBSURFACE CONDITIONS INTERPOLATED BETWEEN BORINGS ARE ESTIMATED BASED ON ACCEPTED SOIL ENGINEERING PRINCIPLES AND GEOLOGIC JUDGEMENT.

SOURCE: MCB CAMP LEJEUNE, MARCH 2000

- LEGEND**
- GEOPROBE® SP-15 SCREEN INTERVAL
 - ESTIMATED CONTACT
 - PROJECTED CONTACT
 - GROUNDWATER ENCOUNTERED DURING DRILLING

FIGURE 3-4
CROSS SECTION B TO B'
RCRA FACILITY INVESTIGATION
SWMU 336, CTO-0091
MARINE CORPS BASE, CAMP LEJEUNE
CAMP LEJEUNE, NORTH CAROLINA



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LEGEND

- CSI TEMPORARY WELL LOCATION
- RFI GROUNDWATER GRAB/SOIL BORING/PIEZOMETER LOCATION
- RFI SOIL BORING/GROUNDWATER GRAB LOCATION
- GROUNDWATER FLOW DIRECTION
- 11.90 - GROUNDWATER CONTOURS (ft msl)

SOURCE: MCB CAMP LEJEUNE, MARCH 2000

FIGURE 3-5
GROUNDWATER CONTOUR MAP
FEBRUARY 2005
RCRA FACILITY INVESTIGATION (RFI)
SWMU 336, CTO - 0091
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

4.0 ANALYTICAL RESULTS AND EXTENT OF CONTAMINATION

This section presents information regarding data quality, provides a brief explanation of the criteria used for comparison of the analytical data, and discusses the analytical results and extent of contamination at the SWMU.

4.1 Data Quality

The following sections present a summary of the data validation/usability assessment as well as a discussion of non-SWMU related contaminants.

4.1.1 Data Validation/Usability Assessment

Data quality evaluations were conducted by E-Data, Inc., Raleigh, NC. Laboratory analytical results were evaluated to assess the technical adequacy and usability of the data. Validation of the data, through established procedures, served to reduce the inherent uncertainties associated with its usability. The data were technically reviewed based on the specifications set forth in the most recent version of the USEPA National Functional Guidelines and USEPA Region III Modifications to the Functional Guidelines. Level M-3 (organics) and IM-2 (metals) technical reviews were performed and included a review/evaluation of the laboratory reporting forms, raw data, instrument printouts, run logs, and supporting data provided by the laboratory.

The analytical data tables included in Section 4.3 indicate which results are considered non-compliant when compared to the requirements set forth in the aforementioned guidelines. The majority of these non-compliant results represents minor quality control problems and do not affect data usability. In most cases, these problems are typical analytical difficulties or are the result of sample matrix problems. The non-compliant results have been "qualified" with an associated explanatory note to clarify the analytical results. The typical qualifiers used included the following:

- J Estimated result; result may not be accurate or precise
- UJ Not detected; the concentration value is an estimate
- U Not detected

Data qualified as "J" were retained as estimated values. Estimated analytical results within a data set are common and considered usable by the USEPA. Data may be qualified as estimated for several reasons, including an exceedence of holding times, high or low surrogate recovery, or intra-sample variability. In addition, values may be assigned an estimated "J" qualifier if the reported value is below the Contract Required Detection Limit (CRDL) or the Contract Required Quantitation Limit (CRQL). No data were rejected. Overall, the data generated are usable, as qualified, for its intended use. The data validation reports are included as Appendix C.

Split samples were collected to assess the reliability of the mobile laboratory. Samples were split for analysis via OLM 4.2 at a fixed-base laboratory. While there is no guidance on comparison of split sample data, rule-of-thumb of a 50% relative percent difference (RPD) for soil is adequate. There were four soil sample splits collected and both the fixed-base and mobile laboratory reported non-detect for most VOCs. All values fall within the RPD rule-of-thumb. There is excellent agreement between non-detects, however there are too few positive detections to make a good assessment.

There were no fixed-based laboratory detections in groundwater to compare groundwater sample split data. In summary, the mobile laboratory data is sufficient for determining the nature and extent of contamination at SWMU 336.

The mobile and fixed base laboratories were able to achieve detection limits below the NC 2L Standard for most of the constituents of concern. In soils, detection limits for some compounds were above NC 2L Standard, including PCE, bromoform, benzo(a)pyrene, and dibenzo(a,h)anthracene. In groundwater, detection limits for some compounds were above NC 2L Standard, including benzene, bromodichloromethane, bromoform, hexachlorobutadiene, PCE, Vinyl Chloride (VC), and bis(2-ethylhexyl)phthalate.

Detection limits below the 2L standard can be achieved for PCE in situations where interferences are limited. Therefore, in accordance with NCAC 2L Groundwater Quality Standards, the extent of PCE and vinyl chloride are to "practical quantitation limits" (detection limits).

4.1.2 Non-SWMU Related Contaminants

Some constituents detected in soil and groundwater at the SWMU can be attributed to non-SWMU related conditions or activities. Two primary sources of non-SWMU related results include laboratory contaminants and naturally occurring inorganic elements. A discussion of non-SWMU related contaminants is provided in the paragraphs that follow.

Laboratory Contaminants

Blank samples (e.g., equipment rinsate blanks, field blanks, laboratory blanks) provide a measure of contamination that has been introduced into a sample set during the collection, transportation, preparation, and/or analysis of the samples. To remove non-SWMU related contaminants from further consideration, the data validator compared concentrations of constituents detected in the blanks to concentrations of the same constituents detected in the environmental samples.

Common laboratory contaminants (i.e., acetone, 2-butanone, methylene chloride, toluene, and phthalate esters) were considered as positive results in the environmental samples only when observed concentrations exceeded ten times the concentration detected in the associated blank(s). If the concentration of a common laboratory contaminant was less than ten times the concentration detected in the associated blank(s), then it was concluded that the constituent was "Not Detected" in that particular sample (USEPA, 1989a). Methylene chloride and toluene were the only common laboratory contaminants detected in the blank samples. These detected concentrations were low and likely not SWMU related.

Other constituents detected in blanks that are not considered common laboratory contaminants were considered as positive results in the environmental samples only when observed concentrations exceeded five times the concentration detected in the associated blank(s) (USEPA, 1989a). Constituent concentrations less than five times the concentration detected in the associated blank(s) were considered to be "Not Detected" in that sample. A summary of constituents detected in the equipment rinsate blank and field blanks is provided in Appendix D.

One field blank was collected from the common source of potable water (FB03-021805) that was used for concurrent RFIs at SWMU 336 and SWMU 303/318. This sample was collected from the helicopter wash pad potable water source at SWMU 303/318 and used for decontamination of drilling equipment. Bromodichloromethane, chloroform, and dibromochloromethane were detected in FB03-021805. These compounds are commonly associated with water treatment

processes and are not likely to be related to SWMU activities. Five metals were also detected in FB03 including arsenic, barium, mercury, selenium, and silver.

Naturally-Occurring Inorganic Elements

Naturally occurring inorganic elements occur ubiquitously in soil and groundwater and distinguishing between background concentrations and SWMU-related concentrations can be difficult. As a result, a Base background soil study and Area of Concern (AOC) background soil study were conducted at the Base in June and July 2000. A Base background groundwater study was conducted in March and April 2002.

The Base background soil study (Baker, 2001a) included surface and subsurface soil sampling at 50 borings advanced in areas that had no known history of any activity that may have biased inorganic concentrations in the soils. The samples were analyzed for Target Analyte List (TAL) metals. In general, inorganic constituents were detected at similar concentrations in the surface and subsurface soil samples. There were observed differences between the data sets but these differences were primarily based on the soil type within each soil horizon. As the soils were separated into data sets based on soil type, it became apparent that the majority of detected constituents were more prevalent in fine-grained soils (clay and silts) than in coarse-grained soils (sands). This was an expected finding since metals are known to adsorb onto clays through formation of ionic bonds.

The purpose of the AOC background soil study (Baker, 2001b) was to establish background concentrations of inorganics for the group of SWMUs located within the AOCs that would be representative of conditions immediately surrounding to the SWMU (resultant of Base activities in that area). An inorganic constituent could be eliminated as a COPC if its concentration is less than the AOC background value for that constituent; arguing that the concentration is a result of Base activities in that AOC and is not directly associated with the SWMU. The AOCs were established based on geographical location, geology, and type of SWMU(s). Surface and subsurface soil samples were collected from 165 borings and analyzed for TAL metals.

The background groundwater study (Baker, 2002) included installing temporary monitoring wells at 25 locations selected to provide spatial coverage across the Base. Two clustered wells were installed at each location. Each cluster contained one shallow well (upper surficial aquifer) and one deeper well (lower surficial aquifer) for a total of 50 temporary wells. Groundwater samples were collected from each well and analyzed TAL metals. In general, similar inorganic constituents were detected in both the shallow and deeper portions of the surficial aquifer. However, the deeper portion of the surficial aquifer appeared to exhibit higher concentrations of metals than the shallow portion.

Statistical analyses were performed on the soil and groundwater data sets to determine the underlying distribution of the data, identify outliers, determine means and standard deviations, and compare data sets of different lithology and depth. The surface and subsurface soil data sets were then segregated according to soil type. The groundwater data set was segregated according to depth.

4.2 Comparison Criteria and Standards

To assist in evaluation of the laboratory analytical results and extent of contamination, the concentrations of constituents detected in soil were compared to USEPA Region IX Preliminary Remediation Goals (PRGs) and North Carolina Soil-to-Groundwater Concentrations (STGCs).

Concentrations of constituents detected in groundwater were compared to North Carolina Water Quality Standards for Groundwater (2L Standards) and USEPA Region IX Tap Water PRGs. As a secondary comparison, metals detected in soil and groundwater at concentrations exceeding the regulatory-driven screening criteria (e.g., PRGs, STGCs, 2L Standards) were compared to Base-wide and/or AOC-specific background screening values. A brief explanation of the criteria used for comparison of the SWMU-specific data is presented below.

USEPA Region IX Industrial Soil and Tap Water PRGs

USEPA Region IX PRGs (USEPA, 2003) are risk-based tools used to screen constituents in environmental media, trigger further investigation, and/or provide an initial cleanup goal if applicable. They are being used to streamline and standardize all stages of the risk decision-making process. The PRGs combine current EPA toxicity values with "standard" exposure factors to estimate constituent concentrations in environmental media (soil, water, and air) that are considered protective of humans, including sensitive groups, over a lifetime. Constituent concentrations above these levels would not automatically trigger a response action; however, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contamination is appropriate.

Given the land use of SWMU 336 and surrounding area, use of the industrial PRGs for soil was considered appropriate.

North Carolina STGCs

North Carolina STGCs (NC, 2005) are soil screening levels protective of groundwater and are based on the current 2L Standards or Interim Maximum Allowable Concentrations (IMACs). If there are no 2L Standards or IMAC values, a soil-to-groundwater concentration can be calculated based on the recommended 2L Standard, or if a recommended 2L Standard is not available, the Maximum Contaminant Level Goals (MCLGs), which are based on a 10^{-6} carcinogenic risk. During the CSI, a Total Organic Carbon (TOC) sample was collected for site specific calculations. Laboratory results indicated TOC at 3732 mg/kg. Therefore site specific criteria were calculated for compounds exceeding the North Carolina generic soil-to-groundwater criteria.

North Carolina 2L Standards

North Carolina 2L Standards (NC, 2005) are maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which otherwise render the groundwater unsuitable for its intended purpose.

Base Background (Soil and Groundwater)/AOC-Specific Background (Soil)

Based on statistical evaluation of the background data sets, metals frequently detected in soil and groundwater were either normally or log-normally distributed. Metals with frequent non-detections were considered neither normally or log-normally distributed. In the later case, the underlying distribution was assumed to be normal. Background values for metals with a normal or assumed normal distribution pattern (neither normally nor log-normally distributed) were calculated based on the arithmetic mean plus two standard deviations. Background values for metals with a lognormal distribution pattern were calculated based on the log arithmetic mean plus two standard deviations. The combined surface soil, sand subsurface soil (Baker, 2001a) and

deeper groundwater (Baker, 2002) Base background data sets were used for comparison. In addition, the AOC 2 background data set for surface and subsurface soil (Baker, 2001b) was used for comparison.

The following decision process was adopted for this report to screen each constituent to determine if an evaluation of the nature and extent of that constituent was warranted:

- If a constituent did not exceed the regulatory-driven screening values (e.g., PRGs, STGCs, 2L Standards), then it was considered as a constituent below screening levels that requires no further action. An evaluation of the nature and extent was not discussed.
- If a constituent exceeded the regulatory-driven screening values and background screening values (metals only), that constituent may be attributable to past practices at the SWMU, and an evaluation of the nature and extent was discussed (see Section 4.4).
- If a constituent exceeded the regulatory-driven screening values, but not the background screening values (metals only), that constituent was considered present at background concentrations and an evaluation of the nature and extent was not discussed even though the constituent exceeded the regulatory-driven screening values.
- If a constituent exceeded the background screening values (metals only), but not the regulatory-driven screening values, that constituent might be a SWMU-related contaminant, but poses no risk to human health or groundwater. An evaluation of the nature and extent was not discussed.

It should be noted that human health and ecological risk assessments generally follow guidelines that are independent of any discussion regarding the nature and extent of contamination. Thus, the list of COPCs may differ between the nature and extent and the risk assessments. Resolution of any differences will be performed in Section 8.0, Conclusions and Recommendations.

4.3 Analytical Results

This section discusses the analytical results for SWMU 336. The analytical results tables presented in this section include only those constituents that were detected (i.e., "Hits"); the tables do not include results for every constituent analyzed. A complete set of analytical results including the CSI results is included as Appendix D.

4.3.1 Surface Soil

A combined total of ten surface soil samples were collected at SWMU 336 during the CSI and RFI field investigations. The samples collected under the CSI were analyzed for VOCs, SVOCs, and/or metals. Samples collected for the RFI were analyzed for VOCs via the mobile laboratory, and metals via the fixed-based laboratory. Laboratory analytical results for positive detections are presented on Tables 4-1 through 4-3.

Ten VOCs were detected in one or more of the surface soil samples. Of these ten VOCs, only methylene chloride was detected at a concentration (SWMU336-TW02-00 at 28 ug/kg) that exceeded the site specific NC STGC of 25 ug/kg. All other VOCs detected did not exceed the established regulatory-driven screening values.

Three SVOCs were detected in one or more of the surface soil samples collected during the CSI. None of these SVOCs were detected at concentrations exceeding the established regulatory-driven screening values.

Seven of the eight RCRA metals were detected in one or more of the surface soil samples. Of these seven metals, only cadmium exceeded the regulatory-driven screening values. Cadmium was detected in surface soil sample SWMU336-TW02-00 at 4.4 mg/kg. This exceeded the North Carolina STGC of 2.72 mg/kg.

Barium was detected in all of the surface soil samples collected at SWMU 336. Only one of these samples (SWMU3365-TW02-00) showed a concentration exceeding the Base Background criteria (23.3 mg/kg) and AOC background criteria (32.62 mg/kg). However, none of these concentrations exceeded the USEPA Region IX PRG of 67,000 mg/kg, as well as the North Carolina STGC screening value of 848 mg/kg.

Chromium was detected in three of the surface soil samples. Two of these samples showed concentrations exceeding the Base Background criteria (12.25 mg/kg). However, none of these concentrations exceeded the USEPA Region IX PRG of 450 mg/kg, as well as the North Carolina STGC screening value of 27.2 mg/kg.

Mercury was detected in two of the surface soil samples at concentrations exceeding the North Carolina STGC. However, the concentrations were below the background screening values.

Figure 4-1 illustrates the distribution of constituents exceeding screening values in soil.

4.3.2 Subsurface Soil

A combined total of sixteen subsurface soil samples were collected at SWMU 336 during the CSI and RFI field investigations. The samples collected under the Phase II CSI were analyzed for VOCs, SVOCs, and/or metals. Samples collected for the RFI were analyzed for VOCs via the mobile laboratory, and/or metals via the fixed-based laboratory. Laboratory analytical results for positive detections are presented on Tables 4-4 through 4-6.

Twenty-four VOCs were detected in one or more of the subsurface soil samples (see Table 4-5 through 4-7). Of these 24 VOCs, methylene chloride (SWMU336-TW01-04 at 41 ug/kg) was detected at a concentration exceeding the site specific North Carolina STGC of 25 ug/kg. The remaining VOCs detected in the samples did not exceed the established regulatory-driven screening values. Figure 4-1 illustrates the distribution of constituents exceeding screening values in soil.

Only one SVOC (bis(2-Ethylhexyl)phthalate) was detected in two of the subsurface soil samples. However, this compound is a typical laboratory contaminant and the concentrations did not exceed the any of the established regulatory-driven screening values.

Six metals were detected in one or more of the subsurface soil samples. Of these six metals, only mercury was detected in SWMU336-TW01-04 and SWMU336-TW02-04 at a concentration exceeding the North Carolina STGC. However, the concentrations did not exceed AOC or Base background concentrations. Selenium was detected in SWMU336-TW06-07 at a concentration exceeding the AOC background criteria. However, this concentration did not exceed the any of the established regulatory-driven screening values.

4.3.3 Groundwater

Groundwater samples were collected from six temporary wells during the CSI. These samples were analyzed for VOCs, SVOCs, and metals. Twelve groundwater samples were collected during the RFI as described in Section 2. These samples were submitted to the on site mobile laboratory and analyzed for VOCs. Laboratory analytical results for positive detections are presented on Tables 4-7 and 4-8.

Fourteen VOCs were detected in one or more of the groundwater samples. Of these 14 VOCs, only tetrachloroethene (PCE) exceeded the North Carolina 2L Standards and/or USEPA Tap Water PRGs. All three exceedences were from temporary wells installed during the Phase II CSI. Those temporary wells included: SWMU336-TW01 (27 ug/L), SWMU336-TW03 (13 ug/L), and SWMU336-TW06 (2.3 J ug/L). These three detections exceeded the North Carolina 2L Standard of 0.7 ug/L and the USEPA Tap Water PRG of 0.66 ug/L.

Naphthalene was detected in SWMU336-GW08-01 at a concentration of 6.6 ug/L. This concentration exceeded the USEPA Tap Water PRG (6.20 ug/L). However, this concentration did not exceed the North Carolina 2L Standard of 21 ug/L. It should be noted that naphthalene was analyzed as a VOC and not as a SVOC.

Figure 4-2 illustrates the distribution of VOC exceedences in groundwater samples collected from the SWMU.

No SVOCs were detected in any of the six groundwater samples collected during the Phase II CSI. Therefore, SVOCs were eliminated as COPCs at SWMU 336 and not analyzed for during the RFI.

Barium, chromium, and lead were detected in one or more of the groundwater samples collected during the CSI. Barium exceeded the Base background screening value of 37.31 ug/L in four of the six groundwater samples. However, none of these metals exceeded either the USEPA Tap Water PRGs or the North Carolina 2L Standards.

4.4 Nature and Extent of Contamination

To facilitate a comprehensive understanding of the extent of contamination at the SWMU, data from this RFI was supplemented with data from Phase II CSI (Appendix D), which included VOCs, SVOCs, and RCRA metals. The distributions of constituents exceeding screening values in soil and groundwater are presented on Figures 4-1 and 4-2.

4.4.1 Soil

The constituents of potential concern (COPCs) in soil associated with the SWMU 336 RFI are cadmium and methylene chloride. While cadmium and methylene chloride were detected during the CSI, neither COPC was detected in soils during the RFI.

The extent of soil contamination in the vicinity of the paint stripper is based these COPCs. These two COPCs represent the only detections above the site specific North Carolina STGC. Methylene chloride was detected at a concentration of 41 ug/kg in subsurface soil sample SWMU336-TW01-04 (7 to 9 feet bgs) and at a concentration of 28 ug/kg in surface soil sample SWMU336-TW02-00. Both of these concentrations exceed the site specific North Carolina STGC of 25 ug/kg.

The exceedences of methylene chloride were found in only the CSI sampling in March of 2002. Methylene chloride is used in solvent extraction methods for laboratory analysis. Due to this usage it is considered a typical laboratory contaminant and makes these detections suspect. Also, the isolated and limited extent of methylene chloride and cadmium suggest that neither constituent represents a confirmed release from the SWMU, nor do they represent a significant impact to the soil.

4.4.2 Groundwater

The only COPC in groundwater associated with SWMU 336 is tetrachloroethene (PCE). PCE was detected in three of the six temporary wells installed during the Phase II CSI. Those temporary wells included: SWMU336-TW01 (27 ug/L), SWMU336-TW03 (13 ug/L), and SWMU336-TW06 (2.3 J ug/L). These three detections exceeded the North Carolina 2L Standard of 0.7 ug/L and the USEPA Tap Water PRG of 0.66 ug/L. It should be noted that groundwater samples collected from SWMU336-TW01 and TW02 during the initial Phase II CSI were labeled SWMU336-GW01 and SWMU336-GW02.

The extent of groundwater contamination in the vicinity SWMU 336 is limited to these detections of PCE. Groundwater samples collected during the RFI revealed no other detections exceeding the applicable screening criteria. Therefore, the groundwater contamination is localized around those three temporary well locations.

4.4.3 Summary

Soil contamination has been delineated at SWMU 336. Concentrations of methylene chloride and cadmium have exceeded the applicable screening criteria and are limited to sample locations SWMU336-TW01-00 and SWMU336-TW04-04.

There is little correlation between soil and groundwater contamination at the SWMU. Groundwater contamination consists of PCE in shallow groundwater. Only one detection of PCE was observed in the site soils at SWMU336-TW01-04 (7 ug/kg) and the concentration was below the applicable screening criteria. Cadmium and methylene chloride were the only compounds detected in soil exceeding the applicable screening criteria. However, neither of these compounds was detected in the groundwater. The observed PCE contamination in groundwater is likely due to SWMU-related activities, but there is no clear source evident in shallow soils.

4.5 References

- | | |
|--------------|--|
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TABLES

TABLE 4-1

DETECTION SUMMARY
SURFACE SOIL - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D. Sample Date Depth Range	Background Criteria AOC 2	Base Background Criteria Surface-Loam/Silt	North Carolina Soil to Groundwater Stds	USEPA Region IX PRGs Residential Soils	SWMU336-TW01-00 03-20-2002 0' - 1'	SWMU336-TW02-00 03-20-2002 0' - 1'	SWMU336-TW03-00 06-23-2003 0-1	SWMU336-TW04-00 06-23-2003 0-1
VOLATILES (ug/kg)								
Acetone	NE	NE	2810	6000000	33	8 J	ND	ND
Methylene Chloride	NE	NE	25 (1)	21000	12	<u>28</u>	ND	ND
Toluene	NE	NE	7270	520000	3 J	ND	ND	ND
Xylenes (Total)	NE	NE	4960	420000	1 J	ND	NA	NA
SEMIVOLATILES (ug/kg)								
bis(2-Ethylhexyl)phthalate	NE	NE	6670	120000	860	100 J	NA	NA
Butylbenzylphthalate	NE	NE	27800	100000000	860	ND	NA	NA
Di-n-octyl phthalate	NE	NE	10000000	25000000	110 J	ND	NA	NA
METALS (mg/kg)								
Arsenic	1.71	1.34	5.24	1.6	0.3 J	0.68 J	ND	ND
Barium	32.62	23.3	848	67000	17.6	<u>48.2</u>	13.6 J	12 J
Cadmium	NE	NE	2.72	450	1.8	<u>4.4</u>	0.49 J	ND
Chromium	19.03	12.25	27.2	450	13.8	15.3	ND	ND
Lead	22.65	26.0	270	750	18.9 J	17.7 J	7.7	6.5
Mercury	0.10	0.128	0.0154	310	<u>0.06</u>	<u>0.06</u>	ND	ND
Selenium	1.21	2.88	12.2	5100	ND	0.62	ND	ND

Notes:

Shaded - Exceeds AOC background concentrations

Bold - Exceeds base background concentrations

Underline - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

AOC comparison - AOC 2 Surface Soil

Base comparison - Loam/Silt Data Set for Surface Soil

⁽¹⁾ - Detected concentrations exceed NC DENR generic soil-to-water criteria

Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.

J - Analyte detected. Report value is estimated.

ND - Not Detected

NE - Not Established

NA - Not Analyzed

TABLE 4-1

DETECTION SUMMARY
 SURFACE SOIL - SWMU 336
 SWMU CONFIRMATORY SAMPLING (CTO-0143)
 MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	Background Criteria	Base Background Criteria	North Carolina Soil to Groundwater Stds	USEPA Region IX PRGs Residential Soils	SWMU336-TW05-00 06-23-2003 0-1	SWMU336-TW06-00 06-23-2003 0-1
Sample Date	AOC 2	Surface-Loam/Silt				
Depth Range						
VOLATILES (ug/kg)						
Acetone	NE	NE	2810	6000000	ND	ND
Methylene Chloride	NE	NE	25 (1)	21000	ND	ND
Toluene	NE	NE	7270	520000	ND	ND
Xylenes (Total)	NE	NE	4960	420000	NA	NA
SEMIVOLATILES (ug/kg)						
bis(2-Ethylhexyl)phthalate	NE	NE	6670	120000	NA	NA
Butylbenzylphthalate	NE	NE	27800	100000000	NA	NA
Di-n-octyl phthalate	NE	NE	10000000	25000000	NA	NA
METALS (mg/kg)						
Arsenic	1.71	1.34	5.24	1.6	0.81 J	ND
Barium	32.62	23.3	848	67000	10.8 J	11.1 J
Cadmium	NE	NE	2.72	450	0.15 J	0.27 J
Chromium	19.03	12.25	27.2	450	ND	ND
Lead	22.65	26.0	270	750	8.2	6.1
Mercury	0.10	0.128	0.0154	310	ND	ND
Selenium	1.21	2.88	12.2	5100	ND	ND

Notes:

Shaded - Exceeds AOC background concentrations

Bold - Exceeds base background concentrations

Underline - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

AOC comparison - AOC 2 Surface Soil

Base comparison - Loam/Silt Data Set for Surface Soil

⁽¹⁾ - Detected concentrations exceed NC DENR generic soil-to-water criteria

Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.

J - Analyte detected. Report value is estimated.

ND - Not Detected

NE - Not Established

NA - Not Analyzed

TABLE 4-2
MOBILE LABORATORY DETECTIONS SUMMARY
RFI SURFACE SOILS - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	NC Soil to	USEPA Region IX Industrial Soil PRGs	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
	Groundwater Standards				
Sample Date			2/1/05	2/1/05	2/2/05
Sample Depth (ft)			0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)					
1,2,3-Trichlorobenzene	<u>2610⁽¹⁾</u>	215925 ⁽¹⁾	0.87 J	5 U	6 U
1,2,4-Trichlorobenzene	<u>2610</u>	215925	0.77 J	5 U	6 U
Bromomethane	NE	8661	6 U	5 U	4.5 J
Chloromethane	20	158167	6 U	5 U	2.2 J
Naphthalene	585	187691	1.1 J	5 U	6 U

Notes:

Underlined values exceed North Carolina Soil to Groundwater criteria.

Boxed values exceed USEPA Region IX Industrial Soil PRGs.

U - Not detected

J - Analyte detected. Reported value is estimated.

ug/kg - micrograms per kilogram

PRG - Preliminary Remediation Goals

⁽¹⁾ Value used is for 1,2,4-trichlorobenzene

TABLE 4-3
FIXED BASE LABORATORY DETECTIONS SUMMARY
RFI SURFACE SOIL - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	AOC 2 Surface Soil	Base Background -	NC Soil to	USEPA Region IX	SWMU336-SB01-00
Sample Date	Background	SS Silt-Loam	Groundwater	Industrial Soil PRGs	2/1/05
Sample Depth (ft)			Standards		0-1
Volatile Organic Compounds (ug/kg)					
ACETONE	NE	NE	2810	54320986	8 J
TRICHLOROFLUOROMETHANE	NE	NE	31500	2000000	1 J
Total Metals (mg/kg)					
BARIUM	32.62	23.3	848	66577	10.4 J
CHROMIUM	19.03	12.25	27.2	448	10.8
LEAD	22.65	26	270	800	6

Notes:

Shaded values exceed AOC 2 background concentrations for surface soil.
 Bolded values exceed Base background concentrations for silt-loam surface soil.
 Underlined values exceed North Carolina Soil to Groundwater criteria.
 Boxed values exceed USEPA Region IX Industrial Soil PRGs.
 J - Analyte detected. Reported value is estimated.
 ug/kg - micrograms per kilogram
 mg/kg - milligrams per kilogram
 PRG - Preliminary Remediation Goals

TABLE 4-4

DETECTION SUMMARY
SUBSURFACE SOIL -SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D. Sample Date Depth Range	Background Criteria AOC 2	Base Background Criteria Subsurface-Clay	<u>North Carolina</u> Soil to Groundwater	<div style="border: 1px solid black; padding: 2px;">USEPA Region IX PRGs Residential Soils</div>	SWMU336-TW01-04 03-20-2002 7' - 9'	SWMU336-TW02-04 03-20-2002 7' - 9'	SWMU336-TW03-04 06-23-2003 7-9	SWMU336-TW04-06 06-23-2003 11-13
VOLATILES (ug/kg)								
1,1,1-Trichloroethane	NE	NE	1670	1200000	5 J	6 U	12 U	14 U
Acetone	NE	NE	2810	6000000	16 UJ	6 J	12 U	14 U
Methylene Chloride	NE	NE	25 (1)	21000	<u>41</u>	9	12 U	14 U
Tetrachloroethene	NE	NE	7.42	3400	7	6 U	12 U	14 U
Toluene	NE	NE	7270	520000	6 U	2 J	12 U	14 U
Trichlorofluoromethane	NE	NE	31500	2000000	6 U	2 J	12 U	14 U
SEMIVOLATILES (ug/kg)								
bis(2-Ethylhexyl)phthalate	NE	NE	6670	120000	430 UJ	95 J	NA	NA
METALS (mg/kg)								
Barium	46.53	28.5	848	67000	11.5	7.1	12.5 J	11.1 J
Cadmium	NE	NE	2.72	450	0.04 U	0.04 U	0.1 U	0.11 U
Chromium	37.71	27.3	27.2	450	11.6	9.5	0.15 U	0.16 U
Lead	15.24	13.7	270	750	5.5 J	4.5 J	6.5	6.6
Mercury	0.07	0.0889	0.0154	310	<u>0.03</u> J	<u>0.03</u> J	0.12 U	0.12 U
Selenium	0.86	1.68	12.2	5100	0.61 U	0.54 U	0.77 J	0.81 UJ

Notes:

Shaded - Exceeds AOC background concentrations

Bold - Exceeds base background concentrations

Underline - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

AOC comparison - AOC 2 Subsurface Soil

Base comparison - Clay Data Set for Subsurface Soil

"" - Detected concentrations exceed NC DENR generic soil-to-water criteria

Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.

J - Analyte detected. Report value is estimated.

ND - Not Detected

NE - Not established

NA- Not analyzed

TABLE 4-4

DETECTION SUMMARY
SUBSURFACE SOIL -SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	Background Criteria	Base Background Criteria	<u>North Carolina</u> <u>Soil to Groundwater</u>	USEPA Region IX PRGs Residential Soils	SWMU336-TW05-04 06-23-2003 7-9	SWMU336-TW06-07 06-23-2003 13-15
Sample Date	AOC 2	Subsurface-Clay				
Depth Range						
VOLATILES (ug/kg)						
1,1,1-Trichloroethane	NE	NE	1670	1200000	12 U	13 U
Acetone	NE	NE	2810	6000000	12 UJ	14
Methylene Chloride	NE	NE	25 (1)	21000	12 U	13 U
Tetrachloroethene	NE	NE	7.42	3400	12 U	13 U
Toluene	NE	NE	7270	520000	12 U	13 U
Trichlorofluoromethane	NE	NE	31500	2000000	12 U	13 U
SEMIVOLATILES (ug/kg)						
bis(2-Ethylhexyl)phthalate	NE	NE	6670	120000	NA	NA
METALS (mg/kg)						
Barium	46.53	28.5	848	67000	15.1 J	15.7 J
Cadmium	NE	NE	2.72	450	0.12 J	0.31 J
Chromium	37.71	27.3	27.2	450	0.15 U	0.15 U
Lead	15.24	13.7	270	750	8	7.3
Mercury	0.07	0.0889	0.0154	310	0.12 U	0.13 U
Selenium	0.86	1.68	12.2	5100	0.73 UJ	1.4 J

Notes:

Shaded - Exceeds AOC background concentrations

Bold - Exceeds base background concentrations

Underline - Exceeds NC DENR soil to groundwater comparison criteria

Boxed - Exceeds USEPA Region IX PRGs

AOC comparison - AOC 2 Subsurface Soil

Base comparison - Clay Data Set for Subsurface Soil

"" - Detected concentrations exceed NC DENR generic soil-to-water criteria

Therefore, site-specific criteria were calculated using a 2L or interim 2L standard and TOC of 3732 mg/kg.

J - Analyte detected. Report value is estimated.

ND - Not Detected

NE - Not established

NA- Not analyzed

TABLE 4-5
MOBILE LABORATORY DETECTIONS SUMMARY
RFI SUBSURFACE SOILS - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	NC Soil to Groundwater Standards	USEPA Region IX Industrial Soil PRGs	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02
Sample Date			2/1/2005	2/1/2005	2/1/2005
Sample Depth (ft)			3-5	7-9	3-5
Volatile Organic Compounds (ug/kg)					
1,2,3-Trichlorobenzene	2610 ⁽¹⁾	215925 ⁽¹⁾	6.11 U	6.11 U	0.65 J
1,2,4-Trichlorobenzene	2610	215925	6.11 U	6.11 U	0.67 J
1,2,4-Trimethylbenzene	7490	170272	2.44 U	2.44 U	2.33 U
1,3,5-Trimethylbenzene	7330	69712	2.44 U	2.44 U	2.33 U
Ethylbenzene	241	395000	1.22 U	1.22 U	1.17 U
Isopropylbenzene	1680	1977451	2.44 U	2.44 U	2.33 U
Naphthalene	585	187691	6.11 U	6.11 U	3.80 J
n-Butylbenzene	4310	240000	2.44 U	2.44 U	2.33 U
n-Propylbenzene	1710	240000	2.44 U	2.44 U	2.33 U
o-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	1.22 U	1.22 U	1.17 U
p&m-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	2.44 U	2.44 U	2.33 U
p-Isopropyltoluene	7270 ⁽³⁾	520000 ⁽³⁾	2.44 U	2.44 U	2.33 U
sec-Butylbenzene	3330	220000	2.44 U	2.44 U	2.33 U
tert-Butylbenzene	3360	390000	2.44 U	2.44 U	2.33 U
Toluene	7270	520000	1.22 U	1.22 U	1.17 U

Notes:

Underlined values exceed North Carolina Soil to Groundwater criteria.

Boxed values exceed USEPA Region IX Industrial Soil PRGs.

U - Not detected

Have not been verified by NC

J - Analyte detected. Reported value is estimated.

ug/kg - micrograms per kilogram

PRG - Preliminary Remediation Goals

⁽¹⁾ Value used is for 1,2,4-trichlorobenzene

⁽²⁾ Value used is for xylenes.

⁽³⁾ Value used is for toluene.

TABLE 4-5
MOBILE LABORATORY DETECTIONS SUMMARY
RFI SUBSURFACE SOILS - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	<u>NC Soil to</u>	USEPA Region IX Industrial Soil PRGs	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02
	<u>Groundwater</u> <u>Standards</u>				
Sample Date			2/1/2005	2/1/2005	2/1/2005
Sample Depth (ft)			7-9	1-3	3-5
Volatile Organic Compounds (ug/kg)					
1,2,3-Trichlorobenzene	2610 ⁽¹⁾	215925 ⁽¹⁾	6.36 U	5.54 U	1.20 J
1,2,4-Trichlorobenzene	2610	215925	6.36 U	5.54 U	1.00 J
1,2,4-Trimethylbenzene	7490	170272	2.50 U	170.00	1.70 J
1,3,5-Trimethylbenzene	7330	69712	2.50 U	130.00	1.10 J
Ethylbenzene	241	395000	1.27 U	1.80 J	1.26 U
Isopropylbenzene	1680	1977451	2.50 U	7.90	2.50 U
Naphthalene	585	187691	6.36 U	5.54 U	1.40 J
n-Butylbenzene	4310	240000	2.50 U	48.00	0.59 J
n-Propylbenzene	1710	240000	2.50 U	17.00	2.50 U
o-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	1.27 U	4.50	1.26 U
p&m-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	2.50 U	5.80	2.50 U
p-Isopropyltoluene	7270 ⁽³⁾	520000 ⁽³⁾	2.50 U	32.00	2.50 U
sec-Butylbenzene	3330	220000	2.50 U	25.00	2.50 U
tert-Butylbenzene	3360	390000	2.50 U	8.40	2.50 U
Toluene	7270	520000	1.27 U	0.63 J	1.26 U

Notes:

Underlined values exceed North Carolina Soil to Groundwater criteria.

Boxed values exceed USEPA Region IX Industrial Soil PRGs.

U - Not detected

J - Analyte detected. Reported value is estimated.

ug/kg - micrograms per kilogram

PRG - Preliminary Remediation Goals

⁽¹⁾ Value used is for 1,2,4-trichlorobenzene

⁽²⁾ Value used is for xylenes.

⁽³⁾ Value used is for toluene.

TABLE 4-5
MOBILE LABORATORY DETECTIONS SUMMARY
RFI SUBSURFACE SOILS - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	NC Soil to	USEPA Region IX Industrial Soil PRGs	SWMU336-SB05-05	SWMU336-SB09-03	SWMU336-SB09-03D
	Groundwater Standards				
Sample Date			2/1/2005	2/2/2005	2/2/2005
Sample Depth (ft)			11-13	5-7	5-7
Volatile Organic Compounds (ug/kg)					
1,2,3-Trichlorobenzene	2610 ⁽¹⁾	215925 ⁽¹⁾	6.41 U	5.92 U	5.83 U
1,2,4-Trichlorobenzene	2610	215925	6.41 U	5.92 U	5.83 U
1,2,4-Trimethylbenzene	7490	170272	2.56 U	2.37 U	2.33 U
1,3,5-Trimethylbenzene	7330	69712	2.56 U	2.37 U	2.33 U
Ethylbenzene	241	395000	1.28 U	1.18 U	1.17 U
Isopropylbenzene	1680	1977451	2.56 U	2.37 U	2.33 U
Naphthalene	585	187691	6.41 U	5.92 U	5.83 U
n-Butylbenzene	4310	240000	2.56 U	2.37 U	2.33 U
n-Propylbenzene	1710	240000	2.56 U	2.37 U	2.33 U
o-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	1.28 U	1.18 U	1.17 U
p&m-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	2.56 U	2.37 U	2.33 U
p-Isopropyltoluene	7270 ⁽³⁾	520000 ⁽³⁾	2.56 U	2.37 U	2.33 U
sec-Butylbenzene	3330	220000	2.56 U	2.37 U	2.33 U
tert-Butylbenzene	3360	390000	2.56 U	2.37 U	2.33 U
Toluene	7270	520000	1.28 U	1.18 U	1.17 U

Notes:

Underlined values exceed North Carolina Soil to Groundwater criteria.

Boxed values exceed USEPA Region IX Industrial Soil PRGs.

U - Not detected

J - Analyte detected. Reported value is estimated.

ug/kg - micrograms per kilogram

PRG - Preliminary Remediation Goals

⁽¹⁾ Value used is for 1,2,4-trichlorobenzene

⁽²⁾ Value used is for xylenes.

⁽³⁾ Value used is for toluene.

TABLE 4-5
MOBILE LABORATORY DETECTIONS SUMMARY
RFI SUBSURFACE SOILS - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID Sample Date Sample Depth (ft)	<u>NC Soil to</u>	<div style="border: 1px solid black; padding: 2px;">USEPA Region IX Industrial Soil PRGs</div>	SWMU336-SB09-06 2/2/2005 13-15
	<u>Groundwater</u>		
	<u>Standards</u>		
Volatile Organic Compounds (ug/kg)			
1,2,3-Trichlorobenzene	2610 ⁽¹⁾	215925 ⁽¹⁾	5.67 U
1,2,4-Trichlorobenzene	2610	215925	5.67 U
1,2,4-Trimethylbenzene	7490	170272	2.27 U
1,3,5-Trimethylbenzene	7330	69712	2.27 U
Ethylbenzene	241	395000	1.13 U
Isopropylbenzene	1680	1977451	2.27 U
Naphthalene	585	187691	5.67 U
n-Butylbenzene	4310	240000	2.27 U
n-Propylbenzene	1710	240000	2.27 U
o-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	1.13 U
p&m-Xylene	4960 ⁽²⁾	420000 ⁽²⁾	2.27 U
p-Isopropyltoluene	7270 ⁽³⁾	520000 ⁽³⁾	2.27 U
sec-Butylbenzene	3330	220000	2.27 U
tert-Butylbenzene	3360	390000	2.27 U
Toluene	7270	520000	1.13 U

Notes:

Underlined values exceed North Carolina Soil to Groundwater criteria.

Boxed values exceed USEPA Region IX Industrial Soil PRGs.

U - Not detected

J - Analyte detected. Reported value is estimated.

ug/kg - micrograms per kilogram

PRG - Preliminary Remediation Goals

⁽¹⁾ Value used is for 1,2,4-trichlorobenzene

⁽²⁾ Value used is for xylenes.

⁽³⁾ Value used is for toluene.

TABLE 4-6
FIXED BASE LABORATORY DETECTIONS SUMMARY
RFI SUBSURFACE SOIL - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	AOC 2 Subsurface Soil	Base Background - SB	NC Soil to	USEPA Region IX	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	Background	Clay	Groundwater	Industrial Soil PRGs	2/1/05	2/1/05	2/2/05
Sample Depth (ft)			Standards		3-5	3-5	11-13
Volatile Organic Compounds (ug/Kg)							
2-BUTANONE	NE	NE	17100	113264388	4 J	NA	NA
4-METHYL-2-PENTANONE	NE	NE	8125	NE	3 J	NA	NA
ACETONE	NE	NE	2810	54320986	31	NA	NA
CARBON DISULFIDE	NE	NE	4940	720000	1 J	NA	NA
METHYL ACETATE	NE	NE	24800	91530825	15	NA	NA
TRICHLOROFLUOROMETHANE	NE	NE	31500	2000000	2 J	NA	NA
Total Metals (mg/kg)							
BARIUM	46.53	28.50	848	66577	17.7 J	16.2 J	9.5 J
CHROMIUM	37.71	27.30	27.2	448	16.3	19.8	6.2
LEAD	15.24	13.70	270	800	10	9.4	6.1

Notes:

Shaded values exceed AOC 2 background concentrations for subsurface soil.
 Bolded values exceed Base background concentrations for clay subsurface soil.
 Underlined values exceed North Carolina Soil to Groundwater criteria.
 Boxed values exceed USEPA Region IX Industrial Soil PRGs.
 J - Analyte detected. Reported value is estimated.
 ug/kg - micrograms per kilogram
 mg/kg - milligrams per kilogram
 NE - Not Established.
 NA - Not Analyzed.
 PRG - Preliminary Remediation Goals

TABLE 4-7

DETECTION SUMMARY
GROUNDWATER - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Base Background Criteria Groundwater-Shallow	North Carolina 2L Groundwater Protection Stds	USEPA Region IX PRGs Tap Water	SWMU336-GW01 04-03-2002	SWMU336-GW02 04-03-2002	SWMU336-TW03 07-16-2003	SWMU336-TW04 07-16-2003
VOLATILES (ug/L)							
1,1,1-Trichloroethane	NE	200	3200	19	5 U	2.8 J	10 U
1,1,2-Trichlorotrifluoroethane	NE	210000	NE	5 U	1 J	10 U	10 U
1,1-Dichloroethane	NE	700	810	21	5 U	10 U	10 U
1,1-Dichloroethene	NE	7	340	2 J	5 U	10 U	10 U
cis-1,2-Dichloroethene	NE	70	61	0.8 J	5 U	10 U	10 U
Tetrachloroethene	NE	0.7	0.66	<u>27</u>	5 U	<u>13</u>	10 U
Toluene	NE	1000	720	5 U	5 U	10 U	10 U
m/p-Xylenes	NE	530	210	NA	NA	20 U	20 U
o-Xylene	NE	530	210	NA	NA	10 U	10 U
METALS (ug/L)							
Barium	37.31	2000	2600	29.3 J	55.2 J	161 J	46.4 J
Chromium	5.76	50	110	0.84 J	2 J	0.8 U	0.8 U
Lead	3.61	15	NE	1.8 U	2.6 J	1.6 U	1.6 U

Notes:

No SVOCs were detected in the samples

Shaded - Exceeds Base Background Criteria Groundwater-Shallow

Bold - Exceeds North Carolina 2L Groundwater Protection Standards

Underline - Exceeds USEPA Region IX PRGs Tap Water

J - Analyte detected. Report value is estimated.

No criteria for speciated xylenes. Total xylene criteria used

ND - Not Detected

NE - Not established

TABLE 4-7

DETECTION SUMMARY
GROUNDWATER - SWMU 336
SWMU CONFIRMATORY SAMPLING (CTO-0143)
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Base Background Criteria Groundwater-Shallow	North Carolina 2L Groundwater Protection Stds	USEPA Region IX PRGs <u>Tap Water</u>	SWMU336-TW05 07-16-2003	SWMU336-TW06 07-16-2003	Exceedance Standard One	Exceedance Standard Two	Exceedance Standard Three
VOLATILES (ug/L)								
1,1,1-Trichloroethane	NE	200	3200	10 U	1.4 J	0	0	0
1,1,2-Trichlorotrifluoroethane	NE	210000	NE	10 U	10 U	0	0	0
1,1-Dichloroethane	NE	700	810	10 U	1.4 J	0	0	0
1,1-Dichloroethene	NE	7	340	10 U	10 U	0	0	0
cis-1,2-Dichloroethene	NE	70	61	10 U	10 U	0	0	0
Tetrachloroethene	NE	0.7	0.66	10 U	<u>2.3</u> J	0	3	3
Toluene	NE	1000	720	3.3 J	10 U	0	0	0
m/p-Xylenes	NE	530	210	1.7 J	20 U	0	2	2
o-Xylene	NE	530	210	0.94 J	10 U	0	2	2
METALS (ug/L)								
Barium	37.31	2000	2600	10.9 J	67.5 J	4	0	0
Chromium	5.76	50	110	0.8 U	0.8 U	0	0	0
Lead	3.61	15	NE	1.6 U	1.6 U	0	0	0

Notes:

No SVOCs were detected in the samples

Shaded - Exceeds Base Background Criteria Groundwater-Shallow

Bold - Exceeds North Carolina 2L Groundwater Protection Standards

Underline - Exceeds USEPA Region IX PRGs Tap Water

J - Analyte detected. Report value is estimated.

No criteria for speciated xylenes. Total xylene criteria used

ND - Not Detected

NE - Not established

TABLE 4-8
MOBILE LABORATORY DETECTIONS SUMMARY
RFI GROUNDWATER - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	North Carolina	USEPA Region IX	SWMU336-GW01	SWMU336-GW01-01	SWMU336-GW04	SWMU336-GW04-01
Sample Date	<u>2L Standards</u>	Tap Water PRGs	2/1/2005	2/1/2005	2/1/2005	2/1/2005
Volatile Organic Compounds (ug/L)						
1,2,3-Trichlorobenzene	70	7.16	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	70	7.16	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	620	183	2 U	2 U	2 U	2 U
Dichlorodifluoromethane	1400	395	5 U	5 U	5 U	5 U
Naphthalene	21	6.20	5 U	5 U	5 U	5 U
p&m-Xylene	530	206	2 U	2 U	2 U	2 U
Toluene	1000	723	1 U	1 U	1 U	1 U

Notes:

U - Not detected.

J - Estimated Value.

ug/L - micrograms per liter

PRG - Preliminary Remedial Goals

Underlined text indicates the concentration exceeded NC 2L Standards.

Boxed cells indicate the concentration exceeded the USEPA Region IX Tap Water PRGs.

(1) Value used is for 1,2,4-Trichlorobenzene.

(2) Value used is for total xylenes.

TABLE 4-8
MOBILE LABORATORY DETECTIONS SUMMARY
RFI GROUNDWATER - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	<u>North Carolina</u>	USEPA Region IX	SWMU336-GW05	SWMU336-GW05-01	SWMU336-GW08	SWMU336-GW08-01
Sample Date	<u>2L Standards</u>	Tap Water PRGs	2/1/2005	2/1/2005	2/4/2005	2/4/2005
Volatile Organic Compounds (ug/L)						
1,2,3-Trichlorobenzene	70	7.16	5 U	5 U	0.73 J	5 U
1,2,4-Trichlorobenzene	70	7.16	5 U	5 U	0.66 J	5 U
1,3-Dichlorobenzene	620	183	2 U	2 U	2 U	2 U
Dichlorodifluoromethane	1400	395	5 U	5 U	5 U	5 U
Naphthalene	21	6.20	5 U	5 U	1 J	6.6
p&m-Xylene	530	206	2 U	2 U	2 U	2 U
Toluene	1000	723	1 U	1 U	1 U	1 U

Notes:

U - Not detected.

J - Estimated Value.

ug/L - micrograms per liter

PRG - Preliminary Remedial Goals

Underlined text indicates the concentration exceeded NC 2L Standards.

Boxed cells indicate the concentration exceeded the USEPA Region IX Tap Water PRGs.

(1) Value used is for 1,2,4-Trichlorobenzene.

(2) Value used is for total xylenes.

TABLE 4-8
MOBILE LABORATORY DETECTIONS SUMMARY
RFI GROUNDWATER - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	<u>North Carolina</u>	<div style="border: 1px solid black; padding: 2px;">USEPA Region IX</div>	SWMU336-GW08-01D	SWMU336-GW09	SWMU336-GW09-01	SWMU336-GW10
Sample Date	<u>2L Standards</u>	<div style="border: 1px solid black; padding: 2px;">Tap Water PRGs</div>	2/4/2005	2/2/2005	2/2/2005	2/4/2005

Volatile Organic Compounds (ug/L)

1,2,3-Trichlorobenzene	70	7.16	5 U	5 U	0.52 J	5 U
1,2,4-Trichlorobenzene	70	7.16	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	620	183	2 U	2 U	0.27 J	2 U
Dichlorodifluoromethane	1400	395	5 U	5 U	5 U	5 U
Naphthalene	21	6.20	3.4 J	0.85 J	1.4 J	3.2 J
p&m-Xylene	530	206	2 U	0.4 J	2 U	2 U
Toluene	1000	723	1 U	0.33 J	1 U	1 U

Notes:

U - Not detected.

J - Estimated Value.

ug/L - micrograms per liter

PRG - Preliminary Remedial Goals

Underlined text indicates the concentration exceeded NC 2L Standards.

Boxed cells indicate the concentration exceeded the USEPA Region IX Tap Water PRGs.

⁽¹⁾ Value used is for 1,2,4-Trichlorobenzene.

⁽²⁾ Value used is for total xylenes.

TABLE 4-8
MOBILE LABORATORY DETECTIONS SUMMARY
RFI GROUNDWATER - SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	<u>North Carolina</u>	<div style="border: 1px solid black; padding: 2px;">USEPA Region IX</div>	SWMU336-GW10-01	SWMU336-GW10D
Sample Date	<u>2L Standards</u>	<div style="border: 1px solid black; padding: 2px;">Tap Water PRGs</div>	2/4/2005	2/4/2005

Volatile Organic Compounds (ug/L)

1,2,3-Trichlorobenzene	70	7.16	5 U	5 U
1,2,4-Trichlorobenzene	70	7.16	5 U	5 U
1,3-Dichlorobenzene	620	183	2 U	2 U
Dichlorodifluoromethane	1400	395	4.3 J	5 U
Naphthalene	21	6.20	5 U	5 U
p&m-Xylene	530	206	2 U	2 U
Toluene	1000	723	1 U	1 U

Notes:

U - Not detected.

J - Estimated Value.

ug/L - micrograms per liter

PRG - Preliminary Remedial Goals

Underlined text indicates the concentration exceeded NC 2L Standards.

Boxed cells indicate the concentration exceeded the USEPA Region IX Tap Water PRGs.

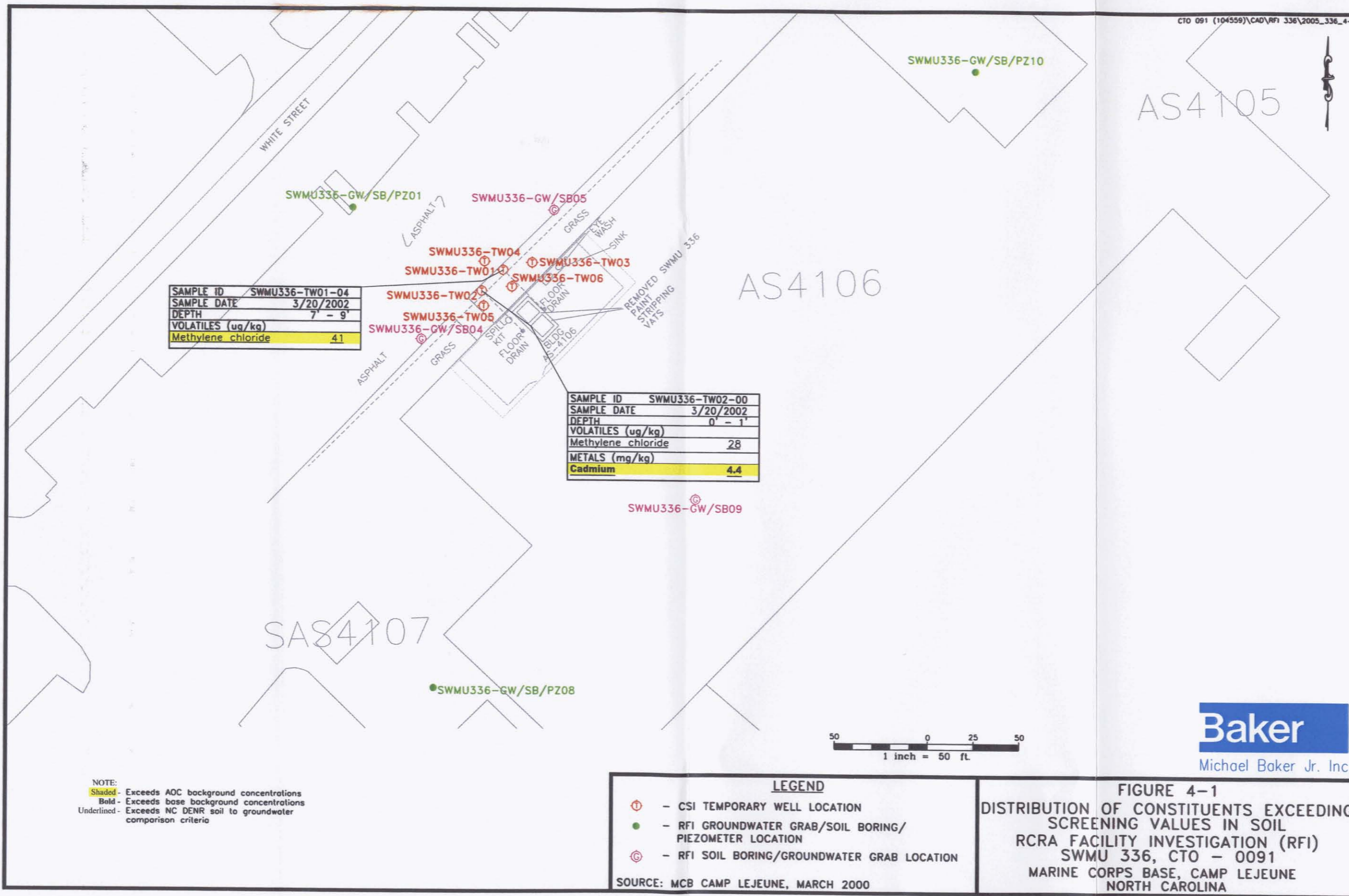
⁽¹⁾ Value used is for 1,2,4-Trichlorobenzene.

⁽²⁾ Value used is for total xylenes.

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FIGURES



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5.0 FATE AND TRANSPORT

The potential for a contaminant to migrate and persist in an environmental medium is critical when evaluating the potential for a constituent to elicit an adverse human health or ecological effect. The environmental mobility of a constituent is influenced by several factors, including the following:

- Its physical and chemical properties
- The physical characteristics of the site
- The site chemistry

The following sections present a discussion of the various physical and chemical properties and potential transport pathways with respect to cadmium, methylene chloride and PCE which were detected at concentrations exceeding the regulatory-driven screening values, as well as the background screening values, and discussed in Section 4.4.

5.1 Physical and Chemical Properties Impacting Fate and Transport

Metals are inherent and occur naturally in soil and groundwater. For this reason, concentrations of metals must be discussed with respect to background or natural concentrations. It is important to note that the fate of metals is significantly affected by soil/aquifer matrix and groundwater chemistry. The concentration of metals and their movement are dependent on such things as ion exchange capacity, pH, and redox potential. Table 5-1 presents an assessment of relative environmental mobility of metals as a function of Eh and pH. As shown on Table 5-1, cadmium exhibits a medium relative mobility.

Table 5-2 presents the physical and chemical properties associated with the PCE and methylene chloride detected during this investigation. These properties determine the inherent environmental mobility and fate of a contaminant. The properties of interest include the following:

- Vapor pressure
- Water solubility
- Octanol/water partition coefficient
- Organic carbon adsorption coefficient (sediment partition)
- Specific gravity
- Henry's Law constant

A discussion of the environmental significance of each of these properties follows.

Vapor pressure provides an indication of the rate at which a chemical may volatilize. It is of primary significance at environmental interfaces such as surface soil/air and surface water/air. Volatilization can be important when evaluating groundwater and subsurface soils, particularly when selecting remedial technologies. Vapor pressure for monocyclic aromatics is generally higher than vapor pressures for PAHs. Contaminants with higher vapor pressures (e.g., VOCs) will enter the atmosphere at a quicker rate than the contaminants with low vapor pressures (e.g., PCBs).

The rate at which a contaminant is leached from soil by infiltrating precipitation is proportional to its water solubility. More soluble contaminants are usually more readily leached than less soluble contaminants. The water solubilities indicate that the volatile organic contaminants, including

monocyclic aromatics, are usually several orders-of-magnitude more soluble than PAHs. Consequently, highly soluble compounds such as the chlorinated VOCs will go into solution faster and possibly in greater concentrations than less soluble compounds. The solubility of a specific compound is dependent on the chemistry of the groundwater and aquifer material. Factors such as groundwater pH, Eh (redox potential), temperature, and the presence of other compounds can greatly affect the solubility.

The octanol/water partition coefficient (K_{ow}) is the ratio of the chemical concentration in octanol divided by the concentration in water. The octanol/water partition coefficient has been shown to correlate well with bioconcentration factors in aquatic organisms and adsorption to soil or sediment. Specifically, a linear relationship between octanol/water partition coefficients and the uptake of chemicals by fatty tissues of animal and human receptors (the bioconcentration factor - BCF) has been established (Lyman et al., 1982). The coefficient is also useful in characterizing the sorption of compounds by organic soils where experimental values are not available.

The organic carbon adsorption coefficient (K_{oc}) indicates the tendency of a chemical to adhere to the organic carbon in soil particles. The solubility of a chemical in water is inversely proportional to the K_{oc} . Contaminants with high soil/sediment adsorption coefficients generally have low water solubilities. For example, contaminants such as PAHs are relatively immobile in the environment, are preferentially bound to the soil, and therefore have a higher K_{oc} value. These compounds are not subject to aqueous transport to the extent of compounds with higher water solubilities. Mechanical activities (e.g., erosion) and the physical characteristics of surface soils may, however, increase the mobility of these bound soil contaminants.

Specific gravity is the ratio of the weight of a given volume of pure chemical at a specified temperature to the weight of the same volume of water at a given temperature. Its primary use is to determine whether a contaminant will have a tendency to "float" or "sink" (as an immiscible liquid) in water if it exceeds its corresponding water solubility.

Vapor pressure and water solubility are of use in determining volatilization rates from surface water bodies and from groundwater. These two parameters can be used to estimate an equilibrium concentration of a contaminant in the water phase and in the air directly above the water. This relationship is expressed as Henry's Law Constant.

A quantitative assessment of mobility has been developed that uses water solubility (S), vapor pressure (VP), and organic carbon partition coefficient (K_{oc}) (Laskowski, 1983). This value is referred to as the Mobility Index (MI). It is defined as:

$$MI = \log((S*VP)/K_{oc})$$

A scale to evaluate MI as presented by Ford and Gurba (1984) is:

<u>Relative MI</u>	<u>Mobility Description</u>
> 5	extremely mobile
0 to 5	very mobile
-5 to 0	slightly mobile
-10 to -5	immobile
< -10	very immobile

The mobility index of PCE and methylene chloride at SWMU 336 is presented on Table 5-2.

5.2 Contaminant Transport Pathways

Based on evaluation of existing conditions at the SWMU, the following potential contaminant transport pathways were identified:

- Wind-blown dust and erosion
- Leaching of soil contaminants to groundwater
- Migration of groundwater contaminants, laterally and vertically

Contaminant concentrations may be affected by one or more mechanisms during transport. Contaminants may be physically transformed by volatilization or precipitation. Contaminants may be chemically transformed through photolysis, hydrolysis, or oxidation/reduction. Contaminants may be biologically transformed by biodegradation. Additionally, contaminants may accumulate in one or more media. Different transformation mechanisms are important for different contaminants; these mechanisms are discussed as necessary in Section 5.3.

The paragraphs that follow describe the potential transport pathways listed above with respect to significant compound concentrations. Significant compound concentrations refer to those compounds discussed in Section 4.0 occurring above comparison criteria. Specific fate and transport concerns are discussed in Section 5.3.

Wind-blown Dust and Erosion

Wind and surface water serves as a constituent transport pathway agent by eroding exposed soil and moving it off site. These processes are influenced by rain, infiltration rate, wind velocity, grain size/density of the soil particles, moisture conditions, and the amount of vegetative cover over the soil.

Elevated concentrations of cadmium and methylene chloride were detected in surface soil sample SWMU336-TW02-00. This sample was collected in a grassy area between the asphalt area/concrete curb and Building AS4106. This area has thick grass cover and shows no evidence of any kind of erosion. Storm water is channeled through roof gutters and storm drains associated with AS4106 and the paved areas surrounding the SWMU. Thus, the likelihood of transport by surface water or wind is negligible.

Leaching of Soil Contaminants to Groundwater

Contaminants that adhere to soil particles or have accumulated in soil pore spaces can leach and migrate vertically to the groundwater as a result of infiltration of precipitation. The rate and extent of this leaching is influenced by several factors, including:

- The depth to the water table
- The amount of precipitation
- The rate of infiltration
- The physical and chemical properties of the soil
- The physical and chemical properties of the contaminant.

Elevated concentrations of cadmium and methylene chloride were limited to surface soil at SWMU336-TW02-00 and one subsurface soil sample SWMU336-TW01-04. As a result, the volume of contaminated soil through which percolating rainwater passes is small. The dissolution of these constituents from soil to groundwater has not resulted in concentrations

exceeding the North Carolina 2L standards. Therefore, leaching of soil contaminants to groundwater is insignificant or not a complete pathway.

Migration of Groundwater Contaminants

Metals leaching from soil to groundwater can migrate as dissolved constituents in groundwater in the direction of groundwater flow. However, as previously discussed, the dissolution of these metals from soil to groundwater has not resulted in concentrations exceeding the North Carolina 2L standards. Therefore, migration of inorganic groundwater contaminants is insignificant or not a complete pathway.

5.2.1 Migration of Groundwater Contaminants

Organic and inorganic contaminants leaching from soil to groundwater can migrate as dissolved constituents in groundwater in the direction of groundwater flow. Three general processes govern the migration of dissolved contaminants caused by groundwater flow: advection, dispersion, and retardation. Advection is a process by which solutes are carried by groundwater movement.

Dispersion is the mixing of contaminated and uncontaminated water during advection. Retardation is the slowing of contaminant migration caused by the reaction of the solute with the aquifer matrix.

A contaminant that is present in water above its solubility concentration will form an immiscible, non-aqueous phase liquid (NAPL). Based on the specific gravity of the contaminant, NAPL will either float or sink in the water. Subsurface transport of the immiscible contaminants is governed by a set of factors different from those of dissolved contaminants. There is no evidence (e.g., concentration, distribution of constituents, and age of contamination) to suggest that NAPL is present at SWMU 336.

Advection is the process by which moving groundwater carries dissolved solutes (Fetter, 1988). Groundwater flow velocities at SWMU 336 were determined by using a variation of Darcy's equation (discussed in Section 2.5.4). Groundwater flow velocity in the surficial aquifer underlying SWMU 336 is approximately 0.01 ft/d, or 3.65 feet per year (Table 5-3). The direction of the local groundwater flow is to the south.

Dispersion results evolve from two basic processes molecular diffusion and mechanical mixing. The kinetic activity of dissolved solutes results in diffusion of solutes from a zone of high concentration to a zone of lower concentration. Dispersion can occur in three directions, longitudinal (in the direction of flow), transverse (horizontally perpendicular to longitudinal), and vertical. Dispersion is largely scale dependent (i.e., the greater the area over which it is measured, the larger the dispersion value). Furthermore, longitudinal dispersion is often observed to be markedly greater than dispersion in the transverse direction of flow. It is often assumed that transverse dispersion is one-tenth longitudinal dispersion (Nichols, 1993). Lacking detailed site studies to determine dispersion, the parameter can be estimated to be one-tenth of the length of the flow path, in the same lithologies (Fetter, 1988).

Retardation is a process whereby a solute concentration is reduced through a chemical, biological, or radioactive change. Solutes can be categorized in two broad classes: conservative and reactive. Conservative solutes do not react with aquifer soil. Reactive solutes will interact with the soil encountered along the flow path through adsorption, partitioning, ion exchange, and other processes. The retardation factor (R) can be calculated by the following equation (Fetter, 1988):

$$R = 1 + (P_b/n)(K_d)$$

Where:

P_b	=	dry bulk density of the soil
n	=	porosity of the soil
k_d	=	distribution coefficient for the solute with the soil (K_{oc} of the solute times the TOC content of the soil)

The retardation factor calculation for PCE is presented in Table 5-3. The lower the retardation factor, the faster the migration rate. These factors are estimated because of the lack of site-specific data, including TOC analytical data and porosity. It is common however, to estimate retardation factors. The relative differences are useful for describing plume characteristics.

Based on a retardation factor (R), a constituent velocity can be estimated by the following equation (Fetter, 1988):

V_{gw} / R , where:

V_{gw}	=	Groundwater velocity
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Table 5-3 presents the estimated contaminant velocity for PCE in groundwater. The approximate constituent velocity is estimated at 0.77 feet per year. It is important to note that this constituent velocity estimate is conservative because it does not account for biodegradation.

Transformation of chlorinated VOCs is an important fate process (USDHHS, 1990). PCE will degrade to trichloroethene. Trichloroethene will in turn, degrade primarily to cis-DCE, and to a lesser extent, trans-1,2-dichloroethene. Cis-DCE will degrade to chloroethane and, to a lesser extent, vinyl chloride. 1,2-Dichloroethene (trans) will degrade to vinyl chloride. Cis-DCE, trichloroethene, trans-1,2-dichloroethene and vinyl chloride have not been detected in groundwater samples at SWMU 336. Therefore, there is no evidence of transformation or degradation of PCE.

Metals are inherent to soil, sediment, and groundwater. For this reason, concentrations of metals must be discussed with respect to background or natural concentrations. Metal solutes behave differently than organic solutes. While the fate and transport of metal solutes generally occur by the same three processes described above, the fate of metals is significantly affected by groundwater and aquifer matrix chemistry. The concentration of metals and their movement are dependent on such things as ion exchange capacity, pH, and redox potential. Table 5-1 presents an assessment of relative environmental mobility of inorganics as a function of Eh and pH. Different metals will behave differently under the same conditions. Metal solutes therefore, need to be examined individually.

5.3 Fate and Transport Summary

The paragraphs that follow discuss transport mechanisms and the fate for the significant contaminants discussed in Section 4.0.

5.3.1 Volatile Organic Compounds

VOCs tend to be mobile in environmental media as indicated by their presence in groundwater and their corresponding MI values/retardation factors. Their environmental mobility is a function of high water solubility's, high vapor pressures, low K_{ow} and K_{oc} values, and high mobility indices. Because VOCs are highly mobile in soil, they will readily leach to underlying groundwater. Detections of VOCs in surface and subsurface soil in and around SWMU 336 indicate no significant source for the groundwater contamination at SWMU 336.

VOCs potentially related to the paint stripper were detected in soil and temporary wells located in and around the SWMU. Figures 4-1 and 4-2 show the distribution of the organics and inorganics in soil and groundwater. Based on each solute's MI value/retardation factor, each solute is expected to migrate at a different rate. Additionally, over time, transformation of the original solutes is expected.

The primary source area has not been positively identified in the vicinity of the SWMU. However, due to the fact that methylene chloride is a compound typically used as a paint remover and PCE is typically used as a degreaser for metals, it is very possible that the drain lines exiting the paint stripping area may have been the source of PCE in groundwater and the methylene chloride detections in soil. It is also possible that the detected methylene chloride is due to laboratory contamination and is not site-related.

5.3.2 Metals

According to Section 4.0, the presence of cadmium in soil above the screening criteria value is limited to one surface soil sample. The concentration of 4.4 mg/kg is relatively low, but does exceed the NC STGC of 2.72 mg/kg. Cadmium is used in the electroplating of aircraft parts and in pigments or paint, therefore consistent with the by-products expected from paint stripping activities at the SWMU. However, due to the limited nature, the low concentration detected, and relative mobility, it is unlikely that the dissolution of cadmium from soils to groundwater would occur. This is evident in the fact that cadmium was not detected in subsurface soils and has not been detected in groundwater at concentrations exceeding NC 2L standards.

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TABLES

TABLE 5-1

RELATIVE MOBILITIES OF METALS AS A FUNCTION OF ENVIRONMENTAL CONDITIONS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Relative Mobility	Environmental Conditions			
	Oxidizing	Acidic	Neutral/Alkaline	Reducing
Very high			Se	
High	Se, Zn	Se, Zn, Cu, Ni, Hg, Ag		
Medium	Cu, Ni, Hg, Ag, As, Cd	As, Cd	As, Cd	
Low	Pb, Ba, Se	Pb, Ba, Be	Pb, Ba, Be	
Very Low	Fe, Cr	Cr	Cr, Zn, Cu, Ni, Hg, Ag	Cr, Se, Zn, Cu, Ni, Hg, Pb, Ba, Be, Ag

Notes:

Se = Selenium

Cd = Cadmium

Zn = Zinc

Ba = Barium

Cu = Copper

Pb = Lead

Ni = Nickel

Fe = Iron

Hg = Mercury

Cr = Chromium

Ag = Silver

Be = Beryllium

As = Arsenic

Zn = Zinc

Source: Swartzbaugh, et al. "Remediating Sites Contaminated with Heavy Metals."
Hazardous Materials Control, November/December 1992.

TABLE 5-2

ORGANIC PHYSICAL AND CHEMICAL PROPERTIES

SWMU-336

RCRA FACILITY INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Constituents of Potential Concern	log K _{ow} (unitless)	Specific Gravity (unitless)	Henry's Law Constant (atm·m ³ /mol)	Mobility Index Input Parameters			Mobility Index	Comments
				Vapor Pressure (mm Hg)	Water Solubility (mg/L)	K _{oc} (mL/g)		
Tetrachloroethene (PCE)	2.60	1.62	2.59E-02	1.78E+01	150	364	0.87	very mobile
methylene chloride	0.95	1.33	4.40E-02	4.31E+03	6500	35	5.90	extremely mobile

Notes:Sources - U.S. Environmental Protection Agency. Superfund Public Health Evaluation Manual. EPA 540/1-86/060 (October, 1986).

NA - Not available

TABLE 5-3

RETARDATION AND VELOCITY CALCULATIONS
SWMU 336
RCRA FACILITY INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Surficial Aquifer								
Constituents of Potential Concern	$K_{oc}^{(1)}$ (mL/g)	$f_{oc}^{(2)}$ (%)	K_d ($K_{oc} \times f_{oc}$)	Bulk Density ⁽³⁾ (g/cm ³)	Soil Porosity ⁽⁴⁾ (%)	Retardation Factor	Groundwater Velocity ⁽⁵⁾ (feet/day)	Constituent Velocity ⁽⁶⁾ (feet/year)
Tetrachloroethene (PCE)	364	0.0024	8.74E-01	1.5	0.3	5.37	0.01	0.77

Source:

⁽¹⁾ Superfund Public Health Evaluation Manual (EPA 540/1-86/060)

⁽²⁾ Base-wide average compiled from various Baker projects

⁽³⁾ Soil Survey of Onslow County, North Carolina

⁽⁴⁾ Effective porosity estimated at 30 %

⁽⁵⁾ Groundwater velocity is determined by:

$$V = K/n_e \times i \quad \text{Where } K = \boxed{2} \text{ feet/day (SWMU 303/318, surficial)}$$

$$n_e = \boxed{0.3} \text{ (effective porosity, see footnote #4)}$$

$$i = \boxed{0.0017} \text{ feet/foot (gradient, Figure 3-5)}$$

⁽⁶⁾ Contaminant velocity is determined by:

$$V_c = V_{gw}/R, \text{ where } V_c = \text{Contaminant velocity}$$

V_{gw} = Groundwater velocity

R = Retardation factor

TABLE 5-3

RETARDATION AND VELOCITY CALCULATIONS
SWMU-360
RCRA FACILITY INVESTIGATION - CTO-0143
MCB, CAMP LEJEUNE, NORTH CAROLINA

Surficial Aquifer								
Constituents of Potential Concern	$K_{oc}^{(1)}$ (mL/g)	$f_{oc}^{(2)}$ (%)	K_d ($K_{oc} \times f_{oc}$)	Bulk Density ⁽³⁾ (g/cm ³)	Soil Porosity ⁽⁴⁾ (%)	Retardation Factor	Groundwater Velocity ⁽⁵⁾ (feet/day)	Constituent Velocity ⁽⁶⁾ (feet/year)
cis 1,2-Dichloroethene	49	0.0024	1.18E-01	1.5	0.3	1.59	0.05	11.58
Tetrachloroethene (PCE)	364	0.0024	8.74E-01	1.5	0.3	5.37	0.05	3.43
Trichloroethene (TCE)	126	0.0024	3.02E-01	1.5	0.3	2.51	0.05	7.32
Vinyl chloride	57	0.0024	1.37E-01	1.5	0.3	1.68	0.05	10.92
Castle Hayne Aquifer								
cis 1,2-Dichloroethene	49	0.0024	1.18E-01	1.5	0.3	1.59	0.27	61.51
Tetrachloroethene (PCE)	364	0.0024	8.74E-01	1.5	0.3	5.37	0.27	18.20
Trichloroethene (TCE)	126	0.0024	3.02E-01	1.5	0.3	2.51	0.27	38.88
Vinyl chloride	57	0.0024	1.37E-01	1.5	0.3	1.68	0.27	58.00

Source:

⁽¹⁾ Superfund Public Health Evaluation Manual (EPA 540/1-86/060)

⁽²⁾ Base-wide average compiled from various Baker projects

⁽³⁾ Soil Survey of Onslow County, North Carolina

⁽⁴⁾ Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (EPA/600/R-98/128)

⁽⁵⁾ Groundwater velocity is determined by:

$$V = K/n_e \times i \text{ Where } K = \boxed{4.2} \text{ feet/day (Table 3-2, surficial)} \quad \boxed{22.3} \text{ feet/day (Table 3-2, Castle Hayne)}$$

$$n_e = \boxed{0.25} \text{ (effective porosity, see footnote \#4)}$$

$$i = \boxed{0.003} \text{ feet/foot (gradient, Figure 3-5)}$$

⁽⁶⁾ Contaminant velocity is determined by:

$$V_c = V_{gw}/R, \text{ where } V_c = \text{Contaminant velocity}$$

$$V_{gw} = \text{Groundwater velocity}$$

$$R = \text{Retardation factor}$$

6.0 HUMAN HEALTH RISK ASSESSMENT

A baseline human health risk assessment (HHRA) was completed as part of the RFI for SWMU 336 to evaluate if unacceptable risks may be associated with potential exposure to existing conditions at the SWMU. The baseline HHRA considers the most likely routes of potential human exposure for both current and future land use scenarios. The baseline HHRA was conducted in accordance with the Risk Assessment Guidance for Superfund (RAGS), Part A, Human Health Evaluation Manual (USEPA, 1989) and the most recent updates, including the reporting format as set forth in RAGS Part D (USEPA, 2001a). USEPA Region IV Supplemental Risk Guidance (USEPA, 2000) was also utilized throughout the baseline HHRA process. Soil and groundwater data from the Phase I (Baker, 2001a) and Phase II (2005) CSI Reports and the 2005 RFI field investigation activities were evaluated in this baseline HHRA.

The baseline HHRA is comprised of eight sections. Section 6.1 presents the SWMU location and characterization. Section 6.2 presents the hazard identification, which presents criteria for selecting COPCs. Sections 6.3 and 6.4 present the exposure assessment and toxicity assessment, respectively. The risk characterization, including a discussion of potential human health effects, is presented in Section 6.5. Section 6.6 outlines the potential sources of uncertainty encountered in the process of performing a risk assessment, and their potential effects on the estimation of human health risks. A summary of the baseline HHRA is provided in Section 6.7. References are provided in Section 6.8.

6.1 Site Location and Characterization

The following information is provided in order to characterize the exposure setting at the SWMU. This background section provides an overview of the characteristics of the SWMU, as well as the SWMU location, a general SWMU description, and the SWMU-specific chemicals as discussed in past reports. The physical characteristics of the SWMU and the geographical areas of concern are also briefly discussed. A complete discussion of the previous investigations and characteristics of the SWMU is included in Section 1.0 of this RFI report.

SWMU 336 consists of a pair of paint stripping vats located in a separate room within Building AS-4106 at MCAS New River. The floor beneath the vats is concrete with two floor drains located on either side of the vats. A spill kit is located near the exit doors. Spills that occur at this SWMU are properly contained and cleaned up according to Base personnel.

SWMU 336 (the paint stripper) is located inside Building AS-4106, on the northwest side of the building. The overall topography in the vicinity of the study area is flat to gently sloping. The surface elevation at White Street is approximately 24-feet above msl. The surface elevation of the asphalt storage area, to the northwest of AS-4106, is approximately 23.4-feet above msl. A concrete drainage channel designed to convey surface water runoff, is located northwest of the SWMU and southeast of White Street.

Surface water flow across the study area is controlled. Due to the developed nature of the study area, rainwater runoff is collected in roof gutters, storm water sewer inlets in parking/storage areas, and in drainage ways along roads. Direct infiltration occurs in the limited grassy areas found along side building AS-4106. During heavy rain events, it is assumed that all surface water flows to the storm water system.

Refer to Section 1.3 for details on previous investigations conducted at the SWMU. Refer to Section 2.0, "Field Investigation," for details on the collection of the samples for the RFI field investigation activities conducted in March and April 2004.

The laboratory results from the Phase I (Baker, 2001a) and Phase II (Baker, 2005) CSI Reports and RFI (2004) sampling activities that were utilized in the human health risk assessment are discussed in Section 6.2 "Hazard Identification."

6.2 Hazard Identification

Data generated during the Phase II CSI and the 2004 RFI field investigation at the SWMU were used to draw conclusions and to identify data gaps in the baseline HHRA. The data were evaluated to assess which data were of sufficient quality to include in the risk assessment. The objective when selecting data to include in the risk assessment was to provide accurate and precise data to characterize contamination and evaluate exposure pathways.

6.2.1 Data Evaluation

The initial hazard identification step included validation and evaluation of available data to determine its usability in the risk assessment. During this validation and evaluation process, data that would result in inaccurate conclusions (e.g., data that were rejected or attributed to blank contamination, as qualified by the validator) were reduced within the data set. Data reduction included removal of unreliable data from the original data set based on guidelines established by USEPA. A summary of the data quality is presented in Section 4.0.

Duplicate sample data were averaged with corresponding environmental sample data and re-included into the data set for these risk evaluations. In instances where the original and duplicate sample result were either both detected or both non-detected, the values were averaged. In instances when the original and duplicate sample result contained one positive detection and one non-detection, the detected value was averaged using one-half of the detection limit of the non-detected value and the averaged sample result was considered a positive detection.

6.2.2 Identification of Data Suitable for Use in a Quantitative Risk Assessment

To provide for accurate conclusions to be drawn from sampling results, analytical data were reviewed and evaluated. This section summarizes the available analytical data for SWMU 336 and the subsequent reduction of these data to the data sets that were used in the HHRA.

Data available for this HHRA included surface soil, subsurface soil, and groundwater data collected for the Phase II CSI (Baker, 2005) and the current RFI field investigation. These investigations were conducted in series with specific goals for each investigation. The Phase II investigation was conducted to determine if activities associated with the SWMU had possibly impacted the environment surrounding the SWMU. Therefore, the samples collected as part of this investigation were located as near to the drain lines exiting the SWMU as physically possible. If a specific group of contaminants were not detected in the samples (e.g. semivolatile organics), then they were eliminated as contaminants of concern for this particular SWMU. As such, subsequent investigations did not include any group of contaminants that had been eliminated as a potential contaminant of concern.

The Phase II CSI (Baker, 2005) was conducted in March/April 2002. Additional samples were collected during a supplemental Phase II investigation conducted in June/July 2003. As part of

the Phase II CSI, soil samples were collected at six temporary well borings advanced within the vicinity of the drain lines exiting the room with the paint stripping vats and groundwater was sampled from six temporary wells. The soil and groundwater samples were analyzed for VOCs, SVOCs, and RCRA metals. Tetrachloroethene (PCE) was detected in groundwater at concentrations exceeding the screening value and a RFI was recommended to adequately characterize the SWMU.

The field investigation for the RFI was conducted by Baker in January and February, 2005. The RFI field investigation included the collection of four surface soil samples (0-1 foot bgs), eleven subsurface soil samples, and twelve groundwater grab samples. The soil and groundwater samples were analyzed for VOCs, and approximately one third of the soil samples were analyzed for RCRA metals. Groundwater samples were additionally analyzed in the field for pH, specific conductance, dissolved oxygen, temperature, and turbidity.

A subset of the available data was used for this HHRA. All surface soil samples collected from 0-1 foot bgs and any subsurface soil data collected from 1 to 13 feet bgs were used in the HHRA. All available groundwater data were included in the risk evaluation. These data are presented in Appendix E.

Shallow groundwater is currently not utilized as a potable source at the site. Although the shallow aquifer is classified as GA (i.e., existing or potential source of drinking water for humans), it is not used as a potable water source at MCB Camp Lejeune because of its low yielding production rates. However, there remains the possibility that upon closure of this facility, residential housing or industrial/commercial buildings could be constructed, and groundwater at the SWMU could be used for potable purposes in the future. Therefore, in accordance with USEPA guidance, groundwater exposure was conservatively evaluated for future residential receptors.

For current receptors (military Base personnel), potable water is supplied by the Base treatment facilities using water supply wells that are set in the lower reaches of the Castle Hayne aquifer (typically 200 to 300 feet bgs). Current operating wells are periodically sampled for control purposes. Hence, assessing current risks to constituents detected in the groundwater for current receptors is unnecessary and, if estimated, may present an unlikely risk. Based on this, groundwater exposure to current receptors was not estimated for this investigation.

Information relating to the nature and extent of contamination at the SWMU is provided in Section 4.0 of this report. The reduced data sets for all site media of concern used in this HHRA are provided in Appendix E of this report.

6.2.3 Criteria for Selecting Chemicals of Potential Concern

As recommended in the USEPA RAGS (USEPA, 1989) and Region IV Bulletin (USEPA, 2000), the following criteria were used to select the COPCs:

- Comparison to USEPA Region IX PRGs
- Comparison to field and laboratory blank data
- Comparison to background or naturally occurring levels

Additional criteria used to assist in the evaluation of COPCs include:

- Historical information

- Persistence
- Mobility
- Toxicity
- ARARs (State and federal standards and criteria)

A brief description of the selection criteria used in selecting final COPCs is presented below. Tables 2.1 through 2.5 of Appendix F present the data and COPC selection summary for each media, grouped according to organic compounds and metals within each table.

USEPA Region IX PRGs - The USEPA Region IX PRGs are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations derived from standardized equations (representing ingestion, dermal contact, and inhalation exposure pathways), combining exposure information assumptions and EPA toxicity data. The PRGs are generic values calculated without using site-specific information and should be viewed as Agency guidelines, not legally enforceable standards. The PRGs for potentially carcinogenic chemicals are based on a target Incremental Lifetime Cancer Risk (ILCR) of 1×10^{-6} . The PRGs for noncarcinogens are based on a target hazard quotient (HQ) of 1.0. In order to account for cumulative risk from multiple chemicals in a medium, it is necessary to derive the PRGs based on a target HQ of 0.1. Noncarcinogenic PRGs based on a target hazard quotient of 0.1 and the most recent toxicological criteria available, results in a set of values that can be used as screening criteria. In order to yield a hazard index of 0.1, the noncarcinogenic PRGs were divided by a factor of ten. For potential carcinogens, the toxicity criteria applicable to derivation of the PRG values are oral and inhalation cancer slope factors (CSFs); for noncarcinogens, they are chronic oral and inhalation reference doses (RfDs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. The PRG table is updated annually to reflect such changes. It should be noted that the most recent update was in October 2004 (USEPA, 2004a).

Tap water PRGs were used as screening values for groundwater based on the conservative assumption that groundwater will be used as a potable supply in the future. It should be noted that in Section 4.0 of this document, industrial soil PRGs were used to assist in evaluation of the laboratory analytical results and extent of contamination based on the nature of land use at SWMU 336 and the surrounding area. However, in accordance with USEPA Region IV guidance and because of the potential for residential use of this site (albeit unlikely), residential soil PRGs were used as screening criteria for soil (USEPA, 2000) in this HHRA. USEPA Region IV guidance recommends industrial screening criteria be used for comparison to subsurface soil data only for construction worker scenarios. Therefore, in the event that constituents in subsurface soil exceeded residential soil PRGs, industrial PRGs were also used for comparison to the subsurface soil when considering the construction worker scenario.

Contaminant Concentrations in Blanks - If a chemical is detected in both the environmental sample and a blank sample, it may not be retained as a COPC in accordance with RAGS Part A depending on the concentration of the chemical in the media (USEPA, 1989). Therefore, blank data were compared with results from environmental samples. If the blanks contained detectable results for common laboratory contaminants (i.e., acetone, 2-butanone, methylene, chloride, toluene, and phthalate esters), environmental sample results were considered as positive results only if they exceeded 10 times the maximum amount detected in the associated blank. If the chemical detected in the blank(s) is not a common laboratory contaminant, environmental sample results were considered as positive results only if they exceeded five times the maximum amount detected in the associated blank(s) (USEPA, 1991a). Furthermore, the elimination of an

environmental sample result would directly correlate to a reduction in the prevalence of the contaminant in that media.

The aforementioned methodologies for evaluating blanks were implemented during third party analytical data validation prior to the selection of COPCs in this HHRA.

Background or Naturally-Occurring Levels - Generally, a comparison to naturally-occurring levels applies only to inorganic analytes, because the majority of organic chemicals are not naturally occurring. Background samples are collected from areas that are not influenced by site contamination. Sample concentrations for surface soil, subsurface soil, and groundwater were compared to base-specific background levels. If the maximum detected concentration of an inorganic was less than two times the average background concentration, it was not retained as a COPC.

Surface and subsurface soil background data were obtained from the Area of Concern Background Study (Baker, 2001b). SWMU-specific background concentrations were established using protocol outlined in Ohio Environmental Protection Agency's (OEPA's) Closure Plan Review Guidance for RCRA Facilities (OEPA, 1999). NC DENR agreed that SWMUs could be grouped together into AOCs based on geographical location, geology, and type of SWMU, and that background concentrations for metals could be established for each of these AOCs. These background data are to be evaluated in comparison to levels of inorganic constituents detected at individual SWMUs to assess whether the presence of such constituents is naturally occurring or may be attributed to activities (past and/or present) within the AOCs. SWMU 336 was included within AOC 2. Therefore, surface and subsurface soil data from the SWMU were compared to the AOC 2 background data set. Background soil data are presented in Tables 2.1 through 2.3 of Appendix F.

Groundwater background data were obtained from the Base Background Groundwater Investigation (Baker, 2002). Background groundwater data were collected from locations throughout the Base away from identified sites in relatively undisturbed areas not near any known sources of contamination. In the Base Background Groundwater Investigation, groundwater data were divided into two categories, including upper (shallow) and lower (deep) portions of the surficial aquifer. Groundwater samples at the SWMU were collected from the shallow portions of the surficial aquifer (less than 25 feet bgs); therefore, they were compared to the background data set for the upper surficial aquifer. Background groundwater data are presented in Tables 2.4 and 2.5 of Appendix F.

Re-inclusion of Chemicals as COPCs - Chemicals can be re-included as COPCs for quantitative evaluation in the baseline HHRA, despite having been eliminated as such from a comparison to PRGs (or other aforementioned criteria). Criteria for reinclusion of chemicals as COPCs are as follows: toxicity, mobility, persistence, and bioaccumulation, chemicals by class (i.e., carcinogenic polynuclear aromatic hydrocarbons [PAHs]), historical use, special exposure routes (i.e., daycares, nursing homes, hospitals), and chemicals with Applicable or Relevant and Appropriate Requirements (ARARs). Each criterion is discussed in the paragraphs that follow.

Toxicity, Mobility, Persistence, and Bioaccumulation - Certain aspects of toxicity of the chemicals must be considered before eliminating them as COPCs. For example, before eliminating potentially carcinogenic chemicals, the weight-of-evidence classification, which indicates the quality and quantity of data underlying a chemical's designation as a potential human carcinogen, should be considered in conjunction with the concentrations detected at the site. It may be practical and conservative to retain a chemical that was detected at low

concentrations if that chemical is a Group A carcinogen. Three additional factors that must be considered for a chemical's retention as a COPC are mobility, persistence, and bioaccumulation. For example, a highly volatile or mobile chemical such as benzene or a long-lived or persistent chemical such as dioxin, probably should remain in the risk assessment.

Chemicals by Class - Chemicals grouped by class, such as PAHs, may be included as a COPC despite the fact that some were detected at levels below the PRG screening criterion, or if toxicity information is not available. Carcinogenic PAHs are known to occur in groups and so their reinclusion can provide a more conservative evaluation for human health and the environment.

Historical Information - Chemicals reliably associated with site activities based on historical information generally should not be eliminated from the quantitative risk assessment, even if they do not exceed relevant criteria.

Special Exposure Routes - For some chemicals, certain exposure routes need to be considered carefully to determine if they should be reincluded. For example, some chemicals are highly volatile and therefore exposure via inhalation during use of contaminated water, particularly for showering may be important exposure routes.

ARARs - Chemicals with ARARs (including those relevant to land ban compliance) usually are not appropriate for exclusion from the quantitative risk assessment. This may, however, depend in part on how the chemicals' site concentrations in specific media compare with their ARAR concentrations for these media. (USEPA, 1989).

Regulatory guidelines are used, when necessary, to infer potential health risks and environmental impacts. Health Advisories (HA) are relevant regulatory guidelines. An explanation of the federal and state criteria and standards used for qualitative evaluation of constituents is presented below. It should be emphasized that COPCs were not chosen based on comparison to state and federal criteria. However, these standards and criteria were used for a qualitative analysis of the COPCs.

North Carolina Water Quality Standards for Groundwater (2L Standards) - North Carolina 2L Standards (15A NCAC 2L. 0202) are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which otherwise render the groundwater unsuitable for its intended purpose (NC, 2005).

USEPA Maximum Contaminant Levels (MCLs) - USEPA MCLs are enforceable standards for public water supplies promulgated under the Safe Drinking Water Act and are designed for the protection of human health while taking into consideration technological and cost considerations. MCLs apply to drinking water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with a lifetime exposure (70-year lifetime) of an average adult (70 kg) consuming 2 liters of water per day. MCLs also consider the technical feasibility of removing the contaminant from the public water supply (USEPA, 1996).

6.2.4 Selection of COPCs

As discussed previously, surface soil, subsurface soil, and groundwater samples were collected at the SWMU during one or more of three different field investigations. The data sets used in this HHRA were combined for each medium and are presented in Appendix E. Tables 2.1 through 2.5 of Appendix F present the selection of COPCs for each environmental medium based on comparisons of maximum detected concentrations of constituents with corresponding USEPA Region IX PRGs, and other applicable criteria (see Section 6.2.1). Constituents retained as COPCs are indicated by shaded cells in the tables.

The following subsections present the rationale for selection of COPCs. Sample locations, analytical results, and corresponding figures are presented in Sections 2.0 and 4.0 and in the appendices of this RFI report.

Surface Soil - Current

Surface soil samples (0 to 1 foot bgs) collected during the Phase II CSI were analyzed for VOCs, SVOCs, and RCRA metals. Surface soil samples collected during the RFI were analyzed for VOCs with approximately one third of the soil samples analyzed for RCRA metals. The surface soil data set for the current exposure scenario includes surface soil samples collected in exposed areas. The surface soil data summary and COPC selection results for the current exposure scenario are presented in Table 2.1 of Appendix F.

There were no detected VOCs that exceeded the residential soil PRGs. Therefore, VOCs were not retained as surface soil COPCs for the current scenario.

There were no detected SVOCs that exceeded the residential soil PRGs. Therefore, SVOCs were not retained as surface soil COPCs for the current scenario.

Cadmium was detected at a maximum concentration greater than its residential soil PRG. Therefore, cadmium was retained as a surface soil COPC for the current scenario.

Surface Soil - Future

Surface soil samples (0 to 1 foot bgs) collected during the Phase II CSI were analyzed for VOCs, SVOCs, and RCRA metals. Surface soil samples collected during the RFI were analyzed for VOCs with approximately one third of the soil samples analyzed for RCRA metals. The surface soil data set for the future exposure scenario includes all surface soil samples including those that are currently covered by asphalt or concrete. For the future scenario, the study area surface soil was assumed to be exposed. The surface soil data summary and COPC selection results for the future exposure scenarios are presented in Table 2.2 of Appendix F.

There were no detected VOCs that exceeded the residential soil PRGs. Therefore, VOCs were not retained as surface soil COPCs for the future scenario.

There were no detected SVOCs that exceeded the residential soil PRGs. Therefore, SVOCs were not retained as surface soil COPCs for the future scenario.

Cadmium was detected at a maximum concentration greater than its residential soil PRG. Therefore, cadmium was retained as a surface soil COPC for the future scenario.

Subsurface Soil

Subsurface soil samples (7 to 13 feet bgs) collected during the Phase II CSI were analyzed for VOCs, SVOCs, and RCRA metals. Subsurface soil samples (1 to 13 feet bgs) collected during the RFI were analyzed for VOCs with approximately one third of the soil samples analyzed for RCRA metals. The subsurface soil data summary and COPC selection results are presented in Table 2.3 of Appendix F.

There were no detected VOCs, SVOCs, or RCRA metals that exceeded the residential PRGs. Therefore, there were no COPCs retained for subsurface soil.

Note that there were no COPCs retained for subsurface soil based on comparison to residential PRGs. It follows that none of the maximum concentrations of detected constituents would exceed industrial PRGs. Therefore, comparison of the subsurface soil data to industrial COPCs is not presented as a separate table.

Groundwater

Groundwater samples were collected from six temporary wells during the Phase II CSI and analyzed for VOCs, SVOCs, and RCRA metals. Groundwater grab samples were collected from eleven locations during the RFI and analyzed for VOCs. The groundwater data summary and COPC selection results are presented in Tables 2.4 and 2.5 of Appendix F. Table 2.4 presents the comparison of groundwater data to Tap Water PRGs. Table 2.5 presents the comparison of groundwater data to North Carolina 2L Standards. Note that COPCs were not selected based on the comparison with North Carolina 2L Standards and hence Table 2.5 is for presentation purposes only.

1,2,3-Trichlorobenzene, naphthalene, and PCE were detected in the groundwater samples at concentrations that exceeded their respective Tap Water PRGs. Therefore, these VOCs were retained as groundwater COPCs. PCE was the only constituent detected at a concentration greater than its North Carolina 2L Standard.

There were no detected RCRA metals that exceeded the Tap Water PRGs. Therefore, metals were not retained as groundwater COPCs.

6.2.5 Summary of COPCs

The following constituents were retained as COPCs for further analysis:

Surface Soil: cadmium

Subsurface Soil (residential and industrial): none

Groundwater: 1,2,3-trichlorobenzene, naphthalene, and PCE

6.3 Exposure Assessment

The exposure assessment estimates the magnitude of actual and/or potential human exposure, the frequency and duration of those exposures, and the pathways (i.e., inhalation, ingestion, and dermal contact) by which people are potentially exposed. To determine whether human exposure could occur at the SWMU in the absence of remedial action, an exposure assessment, which

identifies potential exposure pathways and receptors, was conducted. The following four elements were considered to determine whether a complete exposure pathway was present (USEPA, 1989):

- A source and potential mechanism of chemical release
- An environmental retention or transport medium
- A point of potential human contact with the contaminated medium; and
- A human exposure route (e.g., ingestion) at the contact point.

The exposure scenarios discussed in this report represent USEPA's Reasonable Maximum Exposure (RME). Relevant equations for assessing intakes and exposure factors were obtained from RAGS Part A (USEPA, 1989), Region IV Bulletin (USEPA, 2000), Exposure Factors Handbook (USEPA, 1997), Dermal Exposure Assessment: Principles and Applications, Interim Report (USEPA, 1992), RAGS Part E, Supplemental Guidance for Dermal Risk Assessment Final (USEPA, 2004b), Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure (USEPA, 1993), and Standard Default Exposure Factors, Interim Final (USEPA, 1991b). The Central Tendency (CT) risk descriptor was also used for exposure scenarios when the RME scenarios indicated a potential risk to human health, to more completely present the range of possible risks. The CT exposure calculations use less conservative exposure factors (as appropriate) to calculate chemical intakes for the CT-case scenarios. In this baseline HHRA, the CT exposure scenario was calculated only for those RME exposure scenarios that resulted in unacceptable risk or hazard levels. The inclusion of the CT exposure scenario provides a range of potential carcinogenic risks and noncarcinogenic health hazards with which to make informed risk management decisions when determining remedial action.

6.3.1 Potential Human Receptors

Camp Lejeune operates as a Marine Corps base. It is assumed that long-term plans for the facility and land use are generally the same as the present plan. Based on information available regarding the physical features, site setting, site historical activities, and current and expected land uses, four potential human receptors have been selected for evaluation. These include:

- Future Adolescent (7-16 years) Trespassers
- Current Military Base Personnel
- Future Resident Adults and Children (1-6 years)
- Future Construction Workers

SWMU 336 consists of a pair of paint stripping vats located in a separate room within Building AS-4106 located near the air field MCAS New River. The floor beneath the vats is concrete with two floor drains located on either side of the vats. The old vats have been removed and replaced with a newer, more modern operation. However, the process is still in operation. The area surrounding Building AS-4106 is mostly concrete or asphalt paving. There are some small manicured lawn areas along the building. Access to the study area is restricted to military employees. Current receptors include military Base personnel who may be involved in maintenance activities or paint stripping operations in the area.

Current adult military Base personnel who work or train in the study area may be exposed to COPCs and media of concern at the SWMU. These include military personnel stationed at the Base. A standard tour of duty of four years was assumed. Workers were evaluated for incidental ingestion of and dermal contact with surface soil and inhalation of fugitive dusts from the surface

soil. It should be noted that exposure to surface soil in the study is considered unlikely since it is covered with manicured grass.

At present, shallow groundwater in the vicinity of the SWMU is not utilized for potable purposes. For the current military Base personnel receptors, potable water is derived from water supply wells that withdraw water from the deeper Castle Hayne aquifer. The groundwater is treated at one of five plants on the Base. The nearest water supply well is located approximately 1250-feet hydraulically side-gradient of the SWMU (see Section 3.2). As a result, current groundwater exposure was not assessed. Exposure to subsurface soil in the current scenario is unlikely for the receptor population. Consequently, subsurface soil exposure was not considered to be viable.

Although residential development by the military or general public is unlikely in the industrialized area of the SWMU, future hypothetical residential exposure to children and adults was evaluated. The future adult and child residential receptors could potentially be exposed to COPCs in surface soil by ingestion and dermal contact, and inhalation of dusts from surface soil. Residential receptors could also potentially be exposed to COPCs in subsurface soil (ingestion and dermal contact, and inhalation of dusts) should that soil be excavated. The depths of soil samples considered in the risk evaluation for future residents were 1 to 13 feet bgs. However, there were no COPCs selected for subsurface soil. Therefore, this exposure pathway was not evaluated quantitatively for the future residents in this HHRA. Groundwater at the SWMU is currently not utilized as a potable source. However, it is possible that the groundwater could be used for potable purposes in the future. Therefore, in accordance with USEPA guidance, groundwater exposure via ingestion, dermal contact, and inhalation of volatiles was conservatively evaluated for future residential receptors. Total inorganic results in groundwater were evaluated according to USEPA Region IV guidance.

Future construction workers that may perform excavation and construction at the SWMU were also evaluated for incidental ingestion and dermal contact exposures to excavated surface soil, as well as the inhalation of fugitive dusts emanating from surface soil during excavation/construction activities. The depths of soil samples considered in the risk evaluation for construction workers were 1 to 13 feet bgs. However, there were no COPCs selected for subsurface soil. Therefore, this exposure pathway was not evaluated quantitatively for future construction workers in this HHRA. Construction workers may also be exposed via dermal contact to shallow groundwater when performing excavation activities at the SWMU. Therefore, dermal contact with groundwater is also evaluated for this receptor as a potential exposure pathway.

In summary, the following potential human receptors and exposure pathways were retained for quantitative evaluation in this baseline HHRA.

Current Military Base Personnel

- Incidental Ingestion of Surface Soil
- Dermal Contact with Surface Soil
- Inhalation of Fugitive Dusts Emanating from Surface Soil

Future Adolescent (Ages 7-16 Years) Trespassers

- Incidental Ingestion of Surface Soil
- Dermal Contact with Surface Soil
- Inhalation of Fugitive Dusts Emanating from Surface Soil

Future Adult and Child (Ages 1-6 Years) Residents

- Incidental Ingestion of Surface Soil
- Dermal Contact with Surface Soil
- Inhalation of Fugitive Dusts Emanating from Surface Soil
- Ingestion of Groundwater
- Dermal Contact with Groundwater
- Inhalation of VOCs in groundwater while showering

Future Construction Workers

- Incidental Ingestion of Surface Soil
- Dermal Contact with Surface Soil
- Inhalation of Fugitive Dusts from Surface Soil
- Dermal Contact with Groundwater

6.3.2 Conceptual Site Model

Development of a conceptual site model of potential exposure is critical in evaluating exposures for the human receptors. The conceptual site model considers all reasonable current and future potential exposures and media of concern under a no-action scenario. Current and potential future exposure scenarios for the SWMU are summarized in the conceptual site model presented as Figure 6-1. Current exposures evaluated at the SWMU included military Base personnel. Future exposures evaluated at the SWMU included adolescent trespassers, construction workers, and residents.

Potential contaminant release mechanisms from affected media include stormwater runoff, leaching to underlying groundwater, and advective transport in the direction of groundwater flow. Potentially affected media at the SWMU may include surface and subsurface soil and groundwater.

The current/potential future land use scenarios considered adult exposures. In addition, a residential child, 1-6 years old, and an adolescent trespasser, 7-16 years old, were also considered. Exposure routes (i.e., ingestion, dermal contact, and inhalation) for each exposure scenario are summarized in Figure 6-1.

6.3.3 Quantification of Exposure

Exposure to contaminants is quantified using 1) data from the SWMU (i.e., concentrations of contaminants) and 2) determining human exposure to the environmental media. The chemical concentrations used in the estimation of chronic daily intakes (CDIs) and dermally-absorbed doses (DADs) for each medium are considered to be representative of the types of potential exposures encountered by each receptor throughout the time of exposure. The equations used to calculate the CDIs and DADs for each receptor and exposure pathway are presented in Section 6.3.5. Groundwater is in motion, thus chemical concentrations detected in these media change frequently over time. Soil generally moves more slowly through erosion and deposition. Therefore, groundwater contaminant concentrations may be best represented by the most recently collected data, while soil concentrations can include some older data, as appropriate. The manner in which environmental data are represented also depends on the number of samples and sampling locations available for a given area and a given medium. For example, exposure can

occur at a portion of the SWMU (i.e., a "hotspot") or the entire SWMU, depending on the type of scenario considered for a given receptor.

6.3.4 Data Analysis

USEPA recommends using the average concentration to represent "a reasonable estimate of the concentration likely to be contacted over time" (USEPA, 1989). This concentration, commonly termed the exposure point concentration (EPC), is a conservative estimate of exposure of individuals to chemicals of potential concern at hazardous waste sites. The EPC is determined for each individual exposure unit within a site. An exposure unit is the area throughout which a receptor moves and encounters an environmental medium for the duration of the exposure. Unless there is site-specific evidence to the contrary, an individual receptor is assumed to be equally exposed to media within all portions of the exposure unit over the time frame of the risk assessment (USEPA, 2002a).

USEPA's most recent guidance, Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (USEPA, 2002a), provides tools to calculate upper confidence limits to be used as EPCs in risk assessments. The USEPA 2002 guidance recommends the use of the software package, ProUCL (USEPA, 2001b), to calculate upper confidence limits for use in risk assessments. The most recent version of ProUCL is Version 3.0.

The ProUCL software has been developed by USEPA to compute an appropriate 95% UCL of the unknown population mean. All upper confidence limit computation methods contained in the USEPA guidance documents are available in ProUCL, Version 3.0. ProUCL also can compute a 95% UCL of the mean based upon the gamma distribution, which is better suited to model positively skewed environmental data sets (USEPA, 2001b). ProUCL tests for normality, lognormality, and a gamma distribution of the data set, and computes a conservative and stable 95% UCL of the unknown population mean (assuming the data set consists of points from a single population) (USEPA, 2001b). Several parametric and distribution-free non-parametric methods are included in ProUCL. The upper confidence limit computation methods in ProUCL cover a wide range of skewed data distributions arising from the various environmental applications.

USEPA Region IV groundwater EPC interim guidance (USEPA, 2002b) states that risk screening (carcinogenic and noncarcinogenic) for groundwater exposure should be estimated at each monitoring location for all COPCs. This is to allow the risk assessor to determine if there is a COPC(s) outside the defined contaminant plume that could potentially drive unacceptable risk but is masked because the well is located outside the plume. The center of the plume is defined as the well with the highest summed risk and the wells in close proximity to that well. The average concentration at those points should then be calculated. It may be the case that these criteria are not met, and defining the center of the plume based on the above methodology is not possible. As previously noted, groundwater data for SWMU 336 consist of temporary well samples and groundwater grab samples. There are no permanent monitoring wells were installed. From these data, there was no plume identified at SWMU 336. Therefore, given the type of data and the fact that a plume was not identified, the maximum detected concentrations of the COPCs retained in groundwater were conservatively used as the exposure concentrations.

Frequencies of detection, as well as maximum detected values, are presented in Tables 2.1 through 2.5 of Appendix F. The computational output from the ProUCL calculations performed for each COPC is presented on Tables 3.1.RME through 3.3.RME of Appendix F and in Appendix G. The equations for estimating intakes due to direct exposures to site-related

chemicals for the various identified pathways are presented in Section 6.3.5 and on the risk calculation spreadsheets found in Appendix H.

For results reported as "nondetect" (i.e., results flagged with the following validation qualifiers: U and UJ), a value of one half of the sample-specific detection limit was used to calculate the 95% UCL; the actual value could be between zero and a value just below the detection limit. 95% UCLs were calculated only for the constituents detected in at least one sample collected from the environmental medium of interest.

Estimated concentrations also were used to calculate the 95% UCL, such as "J" qualified (estimated) data. Reported concentrations qualified with an "R" (rejected) were not used in the statistical evaluation.

As previously mentioned, duplicate sample data were averaged with corresponding environmental sample data and re-included into the data set for these risk evaluations. In instances where the original and duplicate sample result were either both detected or both non-detected, the values were averaged for the risk assessment. In instances when the original and duplicate sample result contained one detection and one non-detection, the detected value was averaged with one-half of the detection limit of the non-detected value and the averaged sample result was considered a detection.

Statistical data summary tables (i.e., ProUCL output) for COPCs in each medium sampled (i.e. surface soil and groundwater) are found in the Statistical Summaries presented in Appendix G. These tables provide the arithmetic mean, the standard deviation, and the upper 95 percent confidence limit value based on type of distribution (as determined by ProUCL).

6.3.5 Calculation of Chronic Daily Intakes

In order to numerically estimate the risks for current and future human receptors at the SWMU, a CDI must be estimated for each COPC in every retained exposure pathway. These equations were obtained from USEPA guidance (USEPA, 1989).

The following paragraphs present the general equations used in the calculation of CDIs for each potential exposure pathway. The exposure input parameters used in the calculation of CDIs are presented in Section 6.3.6. Input parameters were taken from USEPA's default exposure factors guidelines where available and applicable. All inputs not defined by USEPA were derived from USEPA documents concerning exposure or from best professional judgment. All exposure assessments incorporate the representative contaminant concentrations in the estimation of intakes. Therefore, only one exposure scenario was developed for each exposure route/receptor combination.

CDIs for carcinogenic effects incorporate terms to represent the exposure duration (years) over the course of a lifetime (70 years or 25,550 days) (USEPA, 1989). Noncarcinogenic CDIs, on the other hand, were estimated using the concept of an average annual exposure. The intake incorporates terms describing the exposure time and/or frequency representing the number of hours per day and the number of days per year that exposure occurs. In general, noncarcinogenic CDIs for many exposure routes (e.g., soil ingestion) are greater for children than adults because of the differences in body weights, similar exposure frequencies, and higher ingestion rates.

6.3.5.1 Surface Soil

Incidental Ingestion of Surface Soil

The following equation was used in the calculation of a CDI (mg/kg/day) for a human receptor who incidentally ingests soil at the site:

$$CDI = \frac{Cs \times IR \times FI \times CF \times EF \times ED}{BW \times AT_c \text{ or } AT_{nc}}$$

Where:

Cs	=	chemical concentration in soil (mg/kg)
IR	=	ingestion rate (mg/day)
FI	=	fraction of soil ingested from the source (unitless)
CF	=	conversion factor (10^{-6} kg/mg)
EF	=	exposure frequency (days/yr)
ED	=	exposure duration (yrs)
BW	=	average body weight (kg)
AT _c	=	averaging time carcinogens (days)
AT _{nc}	=	averaging time, noncarcinogens (days)

Relevant equations and factors required for estimating the daily intake are presented in Appendix H.

Dermal Contact with Surface Soil

The absorbed dose associated with the potential dermal contact of COPCs in soil was calculated using the following equation (USEPA, 1989):

$$DAD = \frac{Cs \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

Where:

DAD	=	Dermally Absorbed Dose, mg/kg-day
Cs	=	Chemical concentration in the soil, mg/kg
AF	=	Adherence Factor, milligram per square centimeter day (mg/cm ² ·d)
ABS	=	Absorbed fraction, unitless
CF	=	Conversion Factor, 10^{-6} mg/kg
SA	=	Surface Area of exposed skin, cm ²
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

Relevant equations and factors required for estimating the absorbed dose are presented in Appendices F and H respectively.

Inhalation of Fugitive Dust from Surface Soil

The daily intake resulting from the inhalation of non-volatile COPCs adsorbed onto fugitive dust particulate was estimated using the following equation (USEPA, 1989):

$$CDI = \frac{Ca \times RR \times ET \times EF \times ED}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Ca	=	Chemical concentration in air as fugitive dust, milligrams per cubic meter (mg/m ³)
RR	=	Respiration Rate, m ³ /hour
ET	=	Exposure Time, hours/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

The air concentration (Ca) of a chemical in fugitive dust emissions was estimated from the following equation, as determined by Cowherd, e al. (1985).

$$Ca = Cs \times 1/PEF$$

Where:

Ca	=	Chemical concentration in air as fugitive dust, mg/m ³
Cs	=	Concentration of chemical in the soil, mg/kg
PEF	=	Particulate Emission Factor, m ³ /kg

Relevant equations and factors required for estimating the inhaled dose are presented in Appendix H.

6.3.5.2 Groundwater

Ingestion of Groundwater

The daily intake associated with the direct potential ingestion of the COPCs in groundwater under a drinking water scenario were calculated using the following equation (USEPA, 1989):

$$CDI = \frac{Cw \times IR \times EF \times ED}{BW \times AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
Cw	=	Chemical concentration in water, mg/L
IR	=	Ingestion Rate, L/day
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

Relevant equations and factors required for estimating the ingested dose are presented in Appendix F.

Dermal Contact with Groundwater

The absorbed dose associated with potential dermal contact with COPCs in groundwater was calculated using the following equation (USEPA, 1989 and 2004b):

$$CDI = \frac{DAD_{event} * EF * ED * CF * SA}{BW * AT}$$

Where:

CDI	=	Chronic Daily Intake, mg/kg-day
DAD _{event}	=	Absorbed dose per event (mg/cm ² -event) (assume 1 event/day)
EF	=	Exposure Frequency, days/year
ED	=	Exposure Duration, years
CF	=	Conversion Factor, 1 L/1000 cm ³
SA	=	Surface Area of exposed skin, cm ²
BW	=	average Body Weight, kg
AT	=	Averaging Time, days

The following equations are used to calculate DAD_{event} for organic compounds:

If $t_{event} \leq t^*$, then

$$DAD_{event} = 2FA * K_p * C_w * \sqrt{\frac{6\tau_{event} * t_{event}}{\pi}}$$

If $t_{event} > t^*$, then

$$DAD_{event} = FA * K_p * C_w \left[\frac{t_{event}}{1+B} + 2\tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right]$$

Where:

DAD _{event}	=	Absorbed dose per event (mg/cm ² -event)
FA	=	Fraction absorbed (dimensionless)
K _p	=	Dermal permeability coefficient of compound in water (cm/hour)
C _w	=	Chemical concentration in water (mg/cm ³)
τ _{event}	=	Lag time per event (hour /event)
t _{event}	=	Event duration (hour /event) (assume 1 event/day)
t*	=	Time to reach steady-state (hour) = 2.4τ _{event}
B	=	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

The following equation is used to calculate DAD_{event} for inorganic and highly ionized organic chemicals:

$$DAD_{event} = K_p * C_w * t_{event}$$

Where:

DAD_{event}	=	Absorbed dose per event (mg/cm ² -event)
K_p	=	Dermal permeability coefficient of compound in water (cm/hour)
C_w	=	Chemical concentration in water (mg/cm ³)
t_{event}	=	Event duration (hours/event) (assume 1 event/day)

Relevant equations and factors required for estimating the absorbed dose are presented in Appendix H.

Inhalation of Volatiles in Groundwater

Inhalation of volatiles in groundwater was calculated according to guidance put forth in the USEPA Region IV Bulletin (USEPA, 2000). Therefore, it was assumed that inhalation of volatiles in groundwater was equivalent to ingesting two liters of water per day. In order to express this quantitatively, the carcinogenic risks and noncarcinogenic health hazards for the ingestion of volatile organic COPCs only were summed and incorporated into the total site risk. This was applied to the adult resident receptors only, as young children typically do not shower.

Relevant equations and factors required for estimating the inhaled dose were calculated and are presented in Appendix H.

6.3.6 Exposure Input Parameters

Tables 4.1.RME through 4.2a.CT of Appendix F present the exposure factors and intake equations used in the estimation of CDIs for each receptor identified below. USEPA promulgated exposure factors are used in conjunction with USEPA standard default exposure factors. When USEPA exposure factors are not available, best professional judgment and site-specific information are used to derive a conservative and defensible value. The following paragraphs present the rationale for the selection of exposure factors for each receptor group evaluated in the baseline HHRA.

6.3.6.1 Current Military Personnel

This scenario assumes that current adult Base military personnel working on-site could come into contact with surface soil at the SWMU. Therefore, this receptor was evaluated for potential exposure to surface soil via incidental ingestion, dermal contact, and inhalation of fugitive dust. A summary of the exposure parameters is discussed in the following paragraphs and presented on Tables 4.1.RME and 4.1a.RME of Appendix F.

The ingestion rate for military personnel exposed to surface soil was assumed to be 100 mg/day (USEPA, 1993), and the fraction ingested was assumed to be 100 percent (professional judgment). An EF of 250 days per year (USEPA, 2004b) was used in conjunction with an exposure duration of 4 years (standard military tour of duty). A respiration rate of 0.55 m³/hr (representing an average of 11.3 m³/day for women and 15.2 m³/day for men) for an adult (USEPA, 1997) was also used. An ET of 8 hours (professional judgment) was used to represent

an average workday. An AT of 70 years or 25,550 days was used for exposure to potentially carcinogenic compounds while an AT of 1,460 days was used for noncarcinogenic exposures. There is a potential for base personnel to absorb COPCs by dermal contact. A skin surface area of 3,300 cm² for an adult (USEPA, 2004b) assumed to wear a short-sleeved shirt, long pants, and shoes, was used to evaluate dermal contact with soil. An AF of 0.2 mg/cm² was used and is based on the 50th percentile weighted AF for utility workers, which is the activity determined by USEPA to represent a reasonable, high-end contact activity (USEPA, 2004b). Dermal absorption fractions provided in USEPA RAGS Part E (USEPA, 2004b).

6.3.6.2 Future Adolescent (7 - 16 years) Trespassers

This scenario assumes that future adolescent (7 - 16 years) trespassers could come into contact with surface soil at the SWMU. These receptors were evaluated for potential exposure to surface soil via incidental ingestion, dermal contact, and inhalation of fugitive dust. A summary of the exposure parameters is discussed in the following paragraphs and presented on Tables 4.1.RME and 4.1a.RME of Appendix F.

A 45 kg adolescent (USEPA, 1997) was assumed to have an exposure duration of 10 years (USEPA, 2000). The ET was estimated to be 4.04 hours per day for an adolescent (USEPA, 1997). The ingestion rate was assumed to be 100 mg/day for the adolescent (USEPA, 1993), with a 100% fraction ingested from the source (professional judgment). The EF was assumed to be 52 events/year, based on anticipated exposures of two days/week (i.e., a weekend) for 6 months (professional judgment). A respiration rate 0.576 m³/hr for adolescent (USEPA, 1997) was also used. The respiration rate used for the adolescent represents the average for an individual aged 9 to 18 years old. ATs of 3,650 days for adolescents for noncarcinogens, and 25,550 days for carcinogens were also used (USEPA, 1989).

The USEPA recommended weighted 0.2 mg/cm² AF for the young child was conservatively used for the adolescent trespasser and is based on the 95th percentile weighted AF for children playing at a day care center or in wet soil (USEPA, 2004b). Dermal absorption values provided in USEPA RAGS Part E (USEPA, 2004b) were also used to estimate soil exposures. A skin surface area of 5,300 cm² for the adolescent (representing 50th percentile body-part AF [average of male/female] for the head, forearms, hands, lower legs and feet of a <7 to <18 year old) (USEPA 2004b) was assumed for the surface soil scenario.

6.3.6.3 Future Adult and Young Child Residents

This scenario assumes that future adult and young child (1-6 years) residents could come into contact with surface soil and subsurface soil at the SWMU. However, as previously noted, exposure to subsurface soil was eliminated from quantitative evaluation because there were no COPCs selected for subsurface soil. It is also conservatively assumed that the groundwater will be potable. Therefore, these receptors could come into contact with contaminants detected in the groundwater under a drinking water scenario in the future, in addition to coming into contact with future surface soil. These receptors were then evaluated for potential exposure to surface soil via incidental ingestion, dermal contact, and inhalation of fugitive dust and groundwater via ingestion, dermal contact, and inhalation of VOCs while showering. A summary of the exposure parameters is discussed in the following paragraphs and presented on Tables 4.1.RME, 4.1a.RME, 4.1.CT, 4.1a.CT, 4.2.RME, 4.2a.RME, 4.2.CT, and 4.2a.CT of Appendix F. Unless otherwise noted, the CT exposure parameters are the same as for RME.

Future adult and young child residents could contact surface soil during outdoor recreational activities such as playing, walking, or running, in the area immediately surrounding their homes or while performing gardening activities. A 70 kg adult and a 15 kg child were assumed for exposure durations of 24 years and 6 years, respectively (USEPA, 1993). Exposure durations of 7 years for the adult and 2 years for the child were used for CT exposure (USEPA, 1993). Exposure times were estimated to be 1.5 hours per day for adults and 5.57 hours per day for the child (USEPA, 1997). The ingestion rate was assumed to be 200 mg/day for the young child and 100 mg/day for the adult (USEPA, 1993), with a 100% fraction ingested from source (professional judgment), over 350 days/year (USEPA, 2004b). Ingestion rates of 100 mg/day for the young child and 50 mg/day for the adult over 234 days per year were used for CT exposure (USEPA, 1993). Respiration rates of 0.308 m³/hr for the child and 0.55 m³/hr for the adult (USEPA, 1997) were also used. The respiration rate used for the young child represents the average for an individual aged 0 to 8 years old. Averaging times of 8,760 days for adults and 2,190 days for children for noncarcinogens, and 25,550 days for carcinogens were also used (USEPA, 1989).

The USEPA recommended weighted AF of 0.07 mg/cm² was used for the residential adult (USEPA, 2004b). This is based on the 50th percentile weighted AF for gardeners, which is the activity determined to represent a reasonable, high-end contact activity. The USEPA recommended weighted 0.2 mg/cm² AF for the young child was used and is based on the 95th percentile weighted AF for children playing at a day care center or in wet soil (USEPA, 2004b). USEPA recommended AF values of 0.01 mg/cm² for the adult and 0.04 mg/cm² for the child were used for the CT exposure scenario (USEPA, 2004b). Dermal absorption values provided in USEPA RAGS Part E (USEPA, 2004b) were also used to estimate soil exposures. Skin surface areas of 2,800 cm² for the young child and 5,700 cm² for the adult (USEPA, 2004b) were assumed for the surface soil scenario. These are the SA values currently recommended by the USEPA for exposure to contaminated soil and are the averages of the 50th percentiles for males and females greater than 18 years of age (adults) and from <1 to <6 years old (young children). As recommended in RAGS Part E, the SA values used for the RME scenario were also assumed for the CT exposure scenario.

Potential exposures to groundwater COPCs may occur under a drinking water scenario. Exposure to total concentrations of groundwater inorganic COPCs were evaluated as per USEPA Region IV guidance. Exposure pathways evaluated for future residents include ingestion, dermal contact, and inhalation of VOCs while showering. Groundwater ingestion rates of 2 L/day and 1 L/day, respectively, were assumed for the adult and young child residents (USEPA, 1993). Exposure frequency of 350 days per year was also assumed for groundwater. Groundwater ingestion rates of 1.4 L/day and 1 L/day (adult and child, respectively) over 234 days per year were used for CT exposure (USEPA, 1993). Total body surface areas of 6,600 cm² and 18,000 cm² (50th percentile values for male and female young children or adults) (USEPA, 2004b) were assumed for the groundwater scenario for the young child and adult, respectively. For the RME scenario, exposure times of 0.58 hour/day and 1 hour/day were assumed for the adult and young child residents (USEPA, 2004b). For CT exposure, 0.25 hour/day and 0.33 hour/day were assumed for the adult and young child (USEPA, 2004b). All other exposure parameters were the same as the soil exposure parameters.

6.3.6.4 Future Adult Construction Workers

Potential exposures to soil COPCs may occur to construction workers while performing soil excavation and construction activities at the SWMU. Exposure pathways evaluated included incidental ingestion, dermal contact, and inhalation of fugitive dust of surface soil, and dermal

contact with shallow groundwater. As previously noted, exposure to subsurface soil was eliminated from quantitative evaluation because there were no COPCs selected for subsurface soil. A summary of the exposure parameters is discussed in the following paragraphs and presented on Tables 4.1.RME, 4.1a.RME, and 4.2.RME of Appendix F. Exposure was assumed to occur for 8 hours per day for soil (USEPA, 1991b) and 2.6 hours per day for groundwater (professional judgment), 250 days per year (USEPA, 2004b), for a construction period of 1 year (professional judgment). A USEPA default value for the soil ingestion rate of 480 mg/day (USEPA, 1993), a 100% fraction ingested from source (professional judgment) and a respiration rate of 3.3 m³/hour (USEPA, 1997) were also assumed for a 70 kg construction worker (USEPA, 1997). A skin surface area of 3,300 cm² for an adult (USEPA, 2004b) assumed to wear a short-sleeved shirt, long pants, and shoes, was used to evaluate dermal contact with soil and groundwater. The soil to skin adherence factor of 0.2 mg/cm² (USEPA, 2004b) was used. Dermal absorption values provided in USEPA RAGS Part E (USEPA, 2004b) were also used to estimate soil exposures. The averaging time of 365 for noncarcinogens and 25,550 days for carcinogens, respectively, were also used (USEPA, 1989).

USEPA believes construction workers are likely to experience substantial exposures to soils during excavation and other work activities. The equation to calculate particulate emission factor (PEF) for a construction scenario has been revised to focus exclusively on emissions from truck traffic on unpaved roads, which typically contribute the majority of dust emissions during construction. A site-specific PEF has been derived for the construction worker scenario for this risk assessment. The "study area" surrounding the SWMU is approximately 1.42 acres in size. The methodologies used to calculate the new PEF are taken from USEPA's Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (Peer Review Draft) (USEPA, 2001c). The following equation was used to calculate the construction scenario PEF:

$$PEF_{sc} = \frac{Q}{C_{sr}} * \frac{1}{F_D} * \left[\frac{T * A_R}{556 * \left(\frac{W}{3}\right)^{0.4} * \left(\frac{365 - p}{365}\right) * VKT} \right]$$

Where:

PEF _{sc}	=	subchronic road particulate emission factor (m ³ /kg)
Q/C _{sr}	=	Inverse of 1-h average air concentration along a straight road segment bisecting a 1.42 acre square site (g/m ² -s per kg/m ³)
F _D	=	dispersion correction factor (unitless) (0.185)
T	=	total time over which construction occurs (s) (8 hours/day for 250 days or 7.2 x 10 ⁶ seconds)
A _R	=	surface area of contaminated road segment (m ²) (1,155 m ²)
W	=	mean vehicle weight (8 tons)
p	=	number of days with at least 0.01 inches of precipitation (days/year) (120 days for the area of Jacksonville, NC)
VKT	=	sum of fleet vehicle kilometers traveled during the exposure duration (km) (570 km assuming a site area of 1.42 acres)

The following assumptions were incorporated into the above-referenced parameters used to calculate the site-specific construction worker scenario. The SWMU covers a small area and is in an industrialized area of the Base. Therefore, it was assumed that daily unpaved road traffic would consist of at most 20 cars (2 tons per car) and 10 trucks (20 tons per truck). A_R is based on

a road length of 100 m and assumes a road width of 15.24 m. VKT is based on 30 vehicles traveling a road length of 76 m (or 0.076 km) for five days per week for 50 weeks (considering an EF of 250 days per year). Thus, a construction worker scenario PEF of $2.77 \times 10^6 \text{ m}^3/\text{kg}$ was calculated. This calculation is also presented in Appendix H.

6.4 Toxicity Assessment

This section reviews the available toxicological information for COPCs retained for quantitative evaluation.

An important component of the HHRA process is the relationship between the dose of a compound (amount to which an individual or population is potentially exposed) and the potential for adverse health effects resulting from exposure to that dose. Dose-response relationships provide a means by which potential public health impacts may be evaluated. Standard RfDs and/or CSFs have been developed for many of the COPCs. This section provides a brief description of these parameters.

6.4.1 Reference Doses

The RfDs are developed for chronic and/or subchronic human exposure to chemicals, and are based solely on the noncarcinogenic effects of chemical substances. These values are defined as an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of adverse effects during a lifetime. The RfD is expressed as dose (mg) per unit body weight (kg) per unit time (day).

6.4.2 Carcinogenic Slope Factors

CSFs are used to estimate an upper bound lifetime probability of an individual developing cancer as a result of exposure to a particular level of a potential carcinogen (USEPA, 1989). This factor is reported in units of proportion (of a population) affected per mg/kg/day and is derived through an assumed low-dosage, linear multistage model and an extrapolation from high to low dose-responses determined from animal studies. The slope factor represents the upper 95th percent confidence limit on the increased cancer risk from a lifetime exposure to an agent. CSFs can also be derived from USEPA promulgated unit risk values for air and/or water. CSFs derived from unit risks cannot, however, be applied to environmental media other than the medium considered in the unit risk estimate.

Slope factors are also accompanied by weight-of-evidence classifications, which designate the strength of the evidence that the COPC is a potential human carcinogen. Quantitative indices of toxicity and USEPA weight-of-evidence classifications are presented in Tables 6.1 and 6.2 of Appendix F for the identified COPCs. The hierarchy (USEPA, 2003) for choosing these toxicity values was:

- Tier 1 - Integrated Risk Information System (IRIS, 2005)
- Tier 2 - USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) (database of values developed on a chemical-specific basis when requested by USEPA's Superfund program)

- Tier 3 – Other Toxicity Values (includes additional USEPA and non-USEPA sources of toxicity information)

IRIS is the generally preferred source of human health toxicity values. IRIS generally contains RfDs, RfCs, CSFs, drinking water unit risk values, and inhalation unit risk values that have gone through a peer review and USEPA consensus review process. IRIS normally represents the official Agency scientific position regarding the toxicity of the chemicals based on the data available at the time of the review.

The second tier is USEPA's PPRTVs. Generally, PPRTVs are derived for one of two reasons. First, the Superfund Health Risk Technical Support Center (STSC) reviews the toxicity values in the Health Effects Assessment Summary Table (HEAST), which is now a Tier 3 source. As the reviews are completed, those toxicity values will be removed from HEAST, and any new toxicity value developed in such a review becomes a PPRTV and placed in the PPRTV database. Second, Regional Superfund Offices may request a PPRTV for contaminants lacking a relevant IRIS value. The STSC uses the same methodologies for both situations.

The third tier includes other sources of information. These sources should provide toxicity information based on similar methods and procedures as those used for Tiers 1 and 2, contain values which are peer reviewed, are available to the public, and are transparent about the methods and processes used to develop the values. Tier 3 sources include, but are not limited to, the following:

- The California Environmental Protection Agency (Cal EPA) toxicity values
- The Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels
- HEAST toxicity values.

6.4.3 Dermal Absorption Efficiency

Many of the RfDs and CSFs are derived from oral toxicological studies based on administered dose, and do not account for the amount of a substance that can penetrate exchange boundaries after contact (e.g., absorbed dose). As a result, there is very little information available regarding dermal toxicity criteria. Therefore, in order to account for a difference in toxicity between an administered dose and an absorbed dose, the RfDs and CSFs (that were based on an administered dose) were adjusted, as described by RAGS Part E (USEPA, 2004b). The adjustment for the oral RfD that would correspond to a dermally absorbed dose is represented by multiplying the RfD by an oral-to-dermal extrapolation value. The adjustment for the oral CSF that would correspond to the dermally-absorbed dose is represented by dividing the CSF by an oral-to-dermal extrapolation value. Recommended oral absorption efficiencies for those compounds/analytes with chemical-specific dermal absorption factors from soil were obtained from RAGS Part E (USEPA, 2004b). The oral-to-dermal extrapolation values were obtained from sources such as the National Center for Environmental Assessment (NCEA) (NCEA, 2000), IRIS, Agency for Toxic Substance and Disease Registry (ATSDR) toxicological profiles, toxicology publications, toxicology references, and USEPA Regional Offices. Only oral-to-dermal extrapolation values that had reference documents available were used in this risk assessment. The oral-to-dermal extrapolation values used in this baseline HHRA for the SWMU are presented in Tables 5.1 and 6.1 of Appendix F.

6.5 Risk Characterization

The risk characterization combines the selected COPCs, the exposure assessment, and the toxicity assessment to produce a quantitative estimate of current and future potential human health risks

associated with the SWMU. Sections 6.5.1 and 6.5.2 discuss the USEPA methodologies used for quantifying and characterizing carcinogenic and noncarcinogenic human health risks. ILCRs and Hazard Indices (HIs) are calculated to characterize potential human health effects. These terms are defined in the sections that follow. ILCRs and HIs are estimated for current and future receptors exposure scenarios that were identified for the SWMU in Section 6.3, and are discussed in Section 6.5.3.

6.5.1 Quantification and Characterization of Carcinogenic Risks

Quantitative risk calculations for potentially carcinogenic compounds estimate inferentially (versus probabilistically) the potential ILCR for an individual in a specified population. This unit of risk refers to a potential cancer risk that is above the background cancer risk in unexposed individuals. For example, an ILCR of 1×10^{-6} indicates that an exposed individual has an increased probability of one in one million of developing cancer subsequent to exposure, over the course of their lifetime.

The potential lifetime ILCR for an individual was estimated from the following relationship:

$$ILCR = \sum_{i=1}^n (CDI_i \text{ or } DAD_i) \times CSF_i$$

where the CSF_i is expressed as $(\text{mg/kg/day})^{-1}$ for compound i , and the chronic daily intake (CDI_i) and dermally absorbed dose (DAD_i) is expressed as mg/kg/day for compound i . Since the units of CSF are $(\text{mg chemical/kg body weight-day})^{-1}$ and the units of intake or dose are $\text{mg chemical/kg body weight-day}$, the ILCR value is dimensionless. The aforementioned equation was derived assuming that cancer is a nonthreshold process and that the potential excess risk level is proportional to the cumulative intake over a lifetime.

For quantitative estimation of risk, it is assumed that cancer risks from various exposure routes are additive. Estimated ILCR values will be compared to 1×10^{-6} to 1×10^{-4} , which represents the target risk range of ILCR values considered by the USEPA to represent an acceptable (i.e., de minimis) risk (USEPA, 1990).

6.5.2 Quantification and Characterization of Noncarcinogenic Risks

Noncarcinogenic compounds assume that a threshold toxicological effect exists. Therefore, the potential for noncarcinogenic effects are calculated by comparing (i.e., dividing) CDI_i and DAD_i levels with $RfDs$ for each COPC.

Noncarcinogenic effects are estimated by calculating the Hazard Quotient (HQ) for individual chemicals and the HI for overall chemicals and pathways by the following equation:

$$HI = \sum_{i=1}^n HQ_i$$

$$\text{where: } HQ_i = \frac{(CDI_i \text{ or } DAD_i)}{RfD_i}$$

An HQ is the ratio of the daily intake or absorbed dose to the reference dose. CDI_i is the chronic daily intake (mg/kg/day) of contaminant i ; DAD_i is the dermally absorbed dose (mg/kg/day) of contaminant i , and RfD_i is the reference dose (mg/kg/day) of the contaminant i over a prolonged period of exposure. Since the units of RfD are mg/kg-day and the units of CDI/DAD are mg/kg-day, the HQ and HI are dimensionless. To account for the additivity of noncarcinogenic risk following exposure to numerous chemicals, the HI, which is the sum of all the HQs, will be calculated. A ratio of 1.0 is used for comparison to the HQ and HI (USEPA, 1990). Ratios less than 1.0 indicate that adverse noncarcinogenic health effects are unlikely. Ratios greater than 1.0 indicate that adverse noncarcinogenic health effects may occur at that exposure level. However, this does not mean that adverse effects will definitely occur, since the RfD incorporates safety and modifying factors to ensure that it is well below that dose for which adverse effects have been observed. This procedure assumes that the risks from exposure to multiple chemicals are additive, an assumption that is probably valid for compounds that have the same target organ or cause the same toxic effect.

6.5.3 Potential Human Health Effects

Both pathway-specific risks and total site risks have been estimated for current military Base personnel, future adolescent trespassers, future residents, and future construction workers at the SWMU. All scenarios evaluated in this baseline HHRA were previously discussed in detail in Section 6.3. All calculation spreadsheets used for estimating potential carcinogenic and noncarcinogenic risks for receptors at the SWMU are presented in Appendix H. Please note that the RAGS Part D tables are presented in Appendix F.

The total site carcinogenic and noncarcinogenic risks estimated for all current and future receptors evaluated in this baseline HHRA are presented in Tables 9.1 through 9.5 of Appendix F.

6.5.3.1 Current Military Base Personnel

Table 9.1RME of Appendix F presents all potential pathway-specific and total site risks estimated for current military Base personnel evaluated for ingestion and dermal exposures to site COPCs in surface soil and inhalation of fugitive dusts from surface soil.

There were no carcinogenic risks or adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the current military Base personnel.

6.5.3.2 Future Adolescent Trespassers

Table 9.2RME of Appendix F present all potential pathway-specific and total site risks estimated for current adult and adolescent trespassers evaluated for ingestion and dermal exposures to site COPCs in surface soil and inhalation of fugitive dusts from surface soil.

There were no carcinogenic risks or adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the current adult and adolescent trespassers.

6.5.3.3 Future Adult and Child Residents

Tables 9.3RME through 9.4CT of Appendix F present all potential pathway-specific and total site risks estimated for future adult and child residents evaluated for ingestion and dermal exposures to site COPCs in surface soil, groundwater, and inhalation of fugitive dusts from surface soil and VOCs in groundwater. As shown in Tables 9.3RME and 9.4RME, there were no adverse

noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the future adult and child residents. As shown in Tables 9.3RME and 9.4RME, the total ILCRs (2.2×10^{-04} and 1.3×10^{-04}) exceed the USEPA acceptable range of 1×10^{-06} to 1×10^{-04} for the future adult and child residents. This is caused by ingestion of and dermal contact with PCE in the shallow groundwater, which contributes approximately 98 percent to the total ILCRs for the adult and young child. As shown in Tables 9.3CT and 9.4CT, the total ILCRs for the adult and child were within USEPA's acceptable range (2.98×10^{-05} for the adult and 2.37×10^{-05} for the child) under the CT exposure scenario.

It should be noted that the maximum detected concentration of PCE in the groundwater data set came from sample SWMU336-GW01, which was collected from a temporary well during the Phase II investigation. It should be noted that PCE was not detected in any of the groundwater samples collected during the RFI. Furthermore, the maximum detected concentrations were used in the risk calculations because there was no definitive plume found at this SWMU. The use of maximum concentrations from SWMU336-GW01 likely overestimates the actual risks to these receptors from the SWMU. It is also unlikely that the shallow groundwater at the SWMU would be used as potable water source.

Therefore, based on the quantitative results of the baseline HHRA, unacceptable risk was calculated for future residents upon exposure to groundwater investigated at the SWMU. However, consideration should be given to the conservatism added to the groundwater exposure evaluation.

6.5.3.4 Future Construction Workers

Table 9.5RME of Appendix F presents all potential pathway-specific and total site risks estimated for future construction workers evaluated for ingestion and dermal exposures to site COPCs in surface soil, inhalation of fugitive dusts from surface soil, and dermal contact with groundwater.

There were no carcinogenic risks or adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the future construction worker.

6.6 Sources of Uncertainty

Uncertainties are encountered throughout the risk assessment process. This section discusses the sources of uncertainty inherent in the following elements of the human health evaluation performed for SWMU 336:

- Sampling and analysis
- Selection of COPCs
- Exposure assessment
- Toxicological assessment
- Human risk characterization

Uncertainties associated with this risk assessment are discussed in the following paragraphs. Table 6-1 summarizes the potential effects of certain uncertainties on the estimation of human health risks.

6.6.1 Sampling and Analysis

The development of a risk assessment depends on the reliability of, and uncertainties associated with, the analytical data available to the risk assessor. These, in turn, are dependent on the operating procedures and techniques applied to the collection of environmental samples in the field and their subsequent analyses in the laboratory. To minimize the uncertainties associated with sampling and analysis at the SWMU, USEPA-approved sampling and analytical methods were employed. Data was generated following USEPA-approved analytical methods. Samples were analyzed for Target Compound List (TCL) VOCs and SVOCs and/or RCRA metals. Samples were taken from locations specified in the approved Work Plan along with the necessary QA/QC samples.

Analytical data are limited by the precision and accuracy of the methods of analysis, which are reflected by the Relative Percent Difference (RPD) of duplicate analyses and the percent recovery of spikes, respectively. In addition, the statistical methods used to compile and analyze the data (mean concentrations, detection frequencies) are subject to the overall uncertainty in data measurement. Furthermore, chemical concentrations in environmental media fluctuate over time and with respect to sampling location. Analytical data must be sufficient to consider the temporal and spatial characteristics of contamination at the site with respect to exposure.

Uncertainty exists also in the fact that contamination may or may not be fully delineated. And so, having a complete data set impacts the representativeness of exposure concentrations derived from the data.

6.6.2 Selection of COPCs

Soil and groundwater water COPCs were selected based on comparisons of the maximum detected concentration with USEPA Region IX PRGs for residential soil (soil) and tap water (groundwater).

PRGs were derived using conservative, USEPA-promulgated default values, and the most recent toxicological criteria available. All non-carcinogenic PRGs were divided by 10 to account for potential additive effects. This adjustment corresponds to assuming an HQ of 0.1, rather than 1.0. This adds additional conservatism to the COPC selection process.

RfDs and CSFs have been combined with "standard" exposure scenarios to calculate the PRGs. Actual exposure scenarios and parameters may differ from those used to calculate the PRG.

Guidance contained within RAGS Volume I, Part A discusses the evaluation of quantitation limits in relationship to whether or not chemicals should be eliminated from a baseline HHRA because they were not detected. In other words, just because a chemical was not detected does not mean it should be deleted from consideration. In the baseline HHRA performed for SWMU 336, only those chemicals that were positively detected were retained for quantitative evaluation in the risk assessment. There is some uncertainty associated with chemicals that may not have been detected, but the sample quantitation limits were greater than corresponding standards and/or criteria. This situation could result in undetected risk. In the case of SWMU 336, several SVOCs and arsenic had detection limits that exceeded the residential soil PRGs. Also, several VOCs, SVOCs, and arsenic had detection limits that exceeded the tap water PRGs. However, there is no historical evidence to indicate that these chemicals are present at SWMU 336.

Given the other conservative aspects of this baseline HHRA, it is anticipated that the contribution associated with sample quantitation limits greater than corresponding criteria to the uncertainty of this risk assessment is low. Furthermore, for chemicals detected just once in a given medium, one half of all detection limits of that chemical (considered as non-detects) are used as proxy calculations in calculating the concentration term. Only those chemicals in a medium that are not positively detected in each sample collected and analyzed are eliminated from further consideration.

Currently, no Base closures are planned for MCB Camp Lejeune; therefore future residential development is unlikely. The application of the residential PRG values to soil and groundwater COPC selections would, therefore, tend to result in a list of COPCs that could be considered conservative for a military base. Conservative COPC selections in the baseline HHRA protects public health because the results of the baseline HHRA determine remedial alternatives and remedial action objectives.

6.6.3 Exposure Assessment

In performing exposure assessments, uncertainties arise from two main sources. First, uncertainties arise in estimating the fate of a compound in the environment, including estimating release and transport in a particular environmental medium. Second, uncertainties arise in the estimation of chemical intakes resulting from contact by a receptor with a particular medium.

To estimate an intake, certain assumptions must be made about exposure events, exposure durations, and the corresponding assimilation of constituents by the receptor. Exposure factors have been generated by the scientific community and have been reviewed by the USEPA. The USEPA has published an Exposure Factors Handbook (USEPA, 1997), which contains the best and latest values. These exposure factors have been derived from a range of values generated by studies of limited numbers of individuals. It is assumed that all potential receptors remain on or near the site throughout the exposure periods and that their exposures to chemicals from the site are all uniform. In all instances, values used in this risk assessment, scientific judgments, and conservative assumptions agree with those of the USEPA.

The use of a RME approach, designed to avoid underestimating daily intakes, was employed throughout this risk assessment. The use of 95% UCL estimates of the arithmetic mean versus mean values as the concentration terms in estimating the CDI or DAD for the soil exposure scenarios and the maximum values as the concentration terms for groundwater exposure scenarios reduces the potential for underestimating exposure at the SWMU.

At sites where soils or groundwater contain VOCs or SVOCs, there is the potential for chemical vapors to migrate from the subsurface to overlying buildings. Vapor intrusion into buildings was not evaluated in this HHRA. Currently there are no structures with enclosed air space that are designed for human occupancy, and it is likely that the future use of the area where the SWMU is located will remain the same. The volatile COPCs detected in the soil and groundwater at SWMU 336 were evaluated under very conservative exposure scenarios and determined not to pose unacceptable risk. Given the conservativeness of the other exposure pathway evaluations in this HHRA, it is estimated that the underestimation of risk associated with not evaluating vapor intrusion into buildings is low.

Inhalation of volatiles in groundwater during trenching activities was also not evaluated in this HHRA. Volatiles were detected in groundwater at low concentrations. Considering the likelihood of dissipation in outdoor air during construction activities and the conservative

evaluation of the dermal contact with groundwater exposure pathway for the construction worker, it is estimated that the underestimation of risk associated with not evaluating the inhalation of volatiles in groundwater for this receptor is low.

6.6.4 Toxicological Assessment

In making quantitative estimates of the toxicity of varying dosages of compounds to human receptors, uncertainties arise from two sources. First, data on human exposure and the subsequent effects are usually insufficient, if they are at all available. Human exposure data usually lack adequate concentration estimations and suffer from inherent temporal variability. Therefore, animal studies are often used and new uncertainties arise from the process of extrapolating animal results to humans. Second, to obtain observable effects with a manageable number of experimental subjects, high doses of a compound are often used. In this situation, a high dose means that high exposures are used in the experiment with respect to most environmental exposures. Therefore, when applying the results of the animal experiment to human exposures, the effects at the high doses must be extrapolated to approximate effects at lower doses.

In extrapolating effects from high doses in animals to low doses in humans, scientific judgment and conservative assumptions are employed. In selecting animal studies for use in dose-response calculations, the following factors are considered:

- Studies are preferred where the animal closely mimics human pharmacokinetics.
- Studies are preferred where dose intake most closely mimics the intake route and duration for humans.
- Studies are preferred which demonstrate the most sensitive response to the compound in question.

For compounds believed to cause threshold effects (i.e., noncarcinogens), safety factors are employed in the extrapolation of effects from animals to humans and from high doses to low doses. In deriving carcinogenic potency factors, the 95% UCL value is promulgated by the USEPA to prevent underestimation of potential risk.

All potential toxic endpoints for human receptors have been addressed to the extent allowed by the data evaluated from the most recent toxicological/epidemiological studies used to derive the cancer slope factors and reference doses. Therefore, any uncertainties associated with toxic endpoints are directly correlated to the information obtained from, and reliability of those studies. Further conservatism in the baseline HHRA is also introduced through the use of experimentally-derived oral absorption efficiencies to account for a difference in the degree of toxicity between an administered dose and an absorbed dose. Equating the absorption efficiency of the dermal bi-phasic barrier to the absorption efficiency of the gastrointestinal lining is a very conservative approach that tends to overestimate the potential risk to human health.

6.6.5 Human Risk Characterization

The risk characterization bridges the gap between potential exposure and the possibility of systemic or carcinogenic human health effects, ultimately providing impetus for the remediation of the site or providing a basis for no remedial action.

Uncertainties associated with risk characterization include the assumption of chemical additivity and the inability to predict synergistic or antagonistic interactions between COPCs. These uncertainties are inherent in any inferential risk assessment. USEPA promulgated inputs to the quantitative risk assessment and toxicological indices are calculated to be protective of the human receptor and to err conservatively, so as to not underestimate the potential human health risks.

6.7 Summary of the Baseline HHRA

Current land use scenarios that were evaluated in this baseline HHRA for SWMU 336 include the military Base personnel. Future land use scenarios that were evaluated include the adolescent trespasser, adult and child residents, and construction worker.

There were no unacceptable carcinogenic risks or adverse noncarcinogenic hazard levels calculated that exceeded USEPA's acceptable criteria for the current military Base personnel, future adolescent trespasser, or future construction worker.

There were no adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the future adult and child residents. The total ILCRs exceeded the USEPA acceptable range of 1×10^{-6} to 1×10^{-4} for the future adult and child residents when considering the RME, or reasonable maximum exposure, scenario. This is caused by ingestion of and dermal contact with PCE in the shallow groundwater. However, it should be noted that the total ILCRs for the adult and child were within USEPA's acceptable range under the CT, or average, exposure scenario.

It should also be noted that the maximum detected concentration of PCE in the groundwater data set came from sample SWMU336-GW01, which was collected from a temporary well during the Phase II investigation. It should be noted that PCE was not detected in any of the groundwater samples collected during the RFI. Furthermore, the maximum detected concentrations were used in the risk calculations because there was no definitive plume found at this SWMU. The use of maximum concentrations from SWMU336-GW01 likely overestimates the actual risks to these receptors from the SWMU. It is also unlikely that the shallow groundwater at the SWMU would be used as potable water source.

Therefore, based on the quantitative results of the baseline HHRA, unacceptable risk was calculated for future residents upon exposure to groundwater investigated at the SWMU. However, consideration should be given to the conservatism added to the groundwater exposure evaluation.

6.8 References

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TABLES

TABLE 6-1
SUMMARY OF UNCERTAINTIES IN THE RESULTS OF THE
HUMAN HEALTH RISK ASSESSMENT
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

	Potential Magnitude for Over-Estimation of Risks	Potential Magnitude for Under-Estimation of Risks	Potential Magnitude for Over or Under- Estimation of Risks
<u>Environmental Sampling and Analysis</u>			
Sufficient samples may not have been taken to characterize the media being evaluated.			Moderate
Systematic or random errors in the chemical analysis may yield erroneous data.			Low
<u>Selection of COPCs</u>			
The use of site-specific background and USEPA Region IV COPC screening concentrations in selecting COPCs in all media of concern.		Low	
<u>Exposure Assessment</u>			
The standard assumptions regarding body weight, exposure period, life expectancy, population characteristics, and lifestyle may not be representative of the actual exposure situations.			Moderate
The use of the 95th percentile upper confidence level data for the normal or lognormal distribution in the estimation of the RME.			Low
The amount of media intake is assumed to be constant and representative of any actual exposure.			Low
<u>Toxicological Assessment</u>			
Toxicological indices derived from high dose animal studies, extrapolated to low dose human exposure.	Moderate		
<u>Risk Characterization</u>			
Assumption of additivity in the quantitation of cancer risks without consideration of synergism, antagonism, promotion and initiation.			Moderate
Assumption of additivity in the estimation of systemic health effects without consideration of synergism, antagonism, etc.			Moderate
Additivity of risks by individual exposure pathways (dermal and ingestion and inhalation).			Low

Notes:

- Low - Assumptions categorized as "low" may effect risk estimates by less than one order of magnitude.
- Moderate - Assumptions categorized as "moderate" may effect estimates of risk by between one and two orders of magnitude.
- High - Assumptions categorized as "high" may effect estimates of risk by more than two orders of magnitude.

Source: Risk Assessment Guidance for Superfund, Volume 1, Part A: Human Health Evaluation Manual. USEPA, 1989.

TABLE 7-1
ECOLOGICAL SCREENING VALUES
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

Analyte	USEPA Region IV Recommended Surface Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference ⁽²⁾	Comment
Volatile Organics:			
1,1,1-Trichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1,2,2-Tetrachloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	--	
1,1,2-Trichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1-Dichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1-Dichloroethene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,2-Dibromoethane	NA	--	
1,2-Dibromo-3-chloropropane (DBCP)	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,2-Dichloroethane	400	MHSPE 1994	
1,2-Dichloropropane	700,000	Efroymson et. al. 1997	
2-Butanone	NA	--	
2-Hexanone	NA	--	
4-Methyl-2-Pentanone	NA	--	
Acetone	NA	--	
Benzene	50	MHSPE 1994	
Bromochloromethane	NA	--	
Bromoform	NA	--	
Bromomethane	NA	--	
Carbon Disulfide	NA	--	
Carbon Tetrachloride	1,000,000	Efroymson et. al. 1997	
Chlorobenzene	50	Beyer 1990	
Chloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Chloroform	1	MHSPE 1994	
Chloromethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
cis-1,2-Dichloroethene	NA	--	
cis-1,3-Dichloropropene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Cyclohexane	100	--	
Dibromochloromethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Dichlorodifluoromethane	100	--	
Ethylbenzene	50	Beyer 1990 and MHSPE 1994	
Isopropylbenzene (Cumene)	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
Methyl Acetate	NA	--	
Methyl Cyclohexane	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
Methyl tert-butyl ether	NA	--	
Methylene Chloride	2000	MHSPE 1994	
Styrene	100	Beyer 1990 and MHSPE 1994	
Tetrachloroethene	10	MHSPE 1994	
Toluene	50	Beyer 1990 and MHSPE 1994	
trans-1,2-Dichloroethene	NA	--	
trans-1,3-Dichloropropene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Trichloroethene (TCE)	1	MHSPE 1994	
Trichlorofluoromethane	100	--	value for aliphatic chlorinated hydrocarbons
Vinyl Chloride	10	MHSPE 1994	
Xylene, m/p	50	Beyer 1990 and MHSPE 1994	value for total xylenes
Xylene, o-	50	Beyer 1990 and MHSPE 1994	value for total xylenes
Xylene (Total)	50	Beyer 1990 and MHSPE 1994	
Semivolatile Organics:			
1,1'-Biphenyl	NA	--	
1,2,4-Trichlorobenzene	10	MHSPE 1994	value for trichlorobenzene
1,2-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
1,3-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
1,4-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
2,2'-Oxybis (1-Chloropropane)	NA	--	
2,4,5-Trichlorophenol	4,000	Efroymson et. al. 1997	
2,4,6-Trichlorophenol	10,000	Efroymson et. al. 1997	

TABLE 7-1
ECOLOGICAL SCREENING VALUES
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

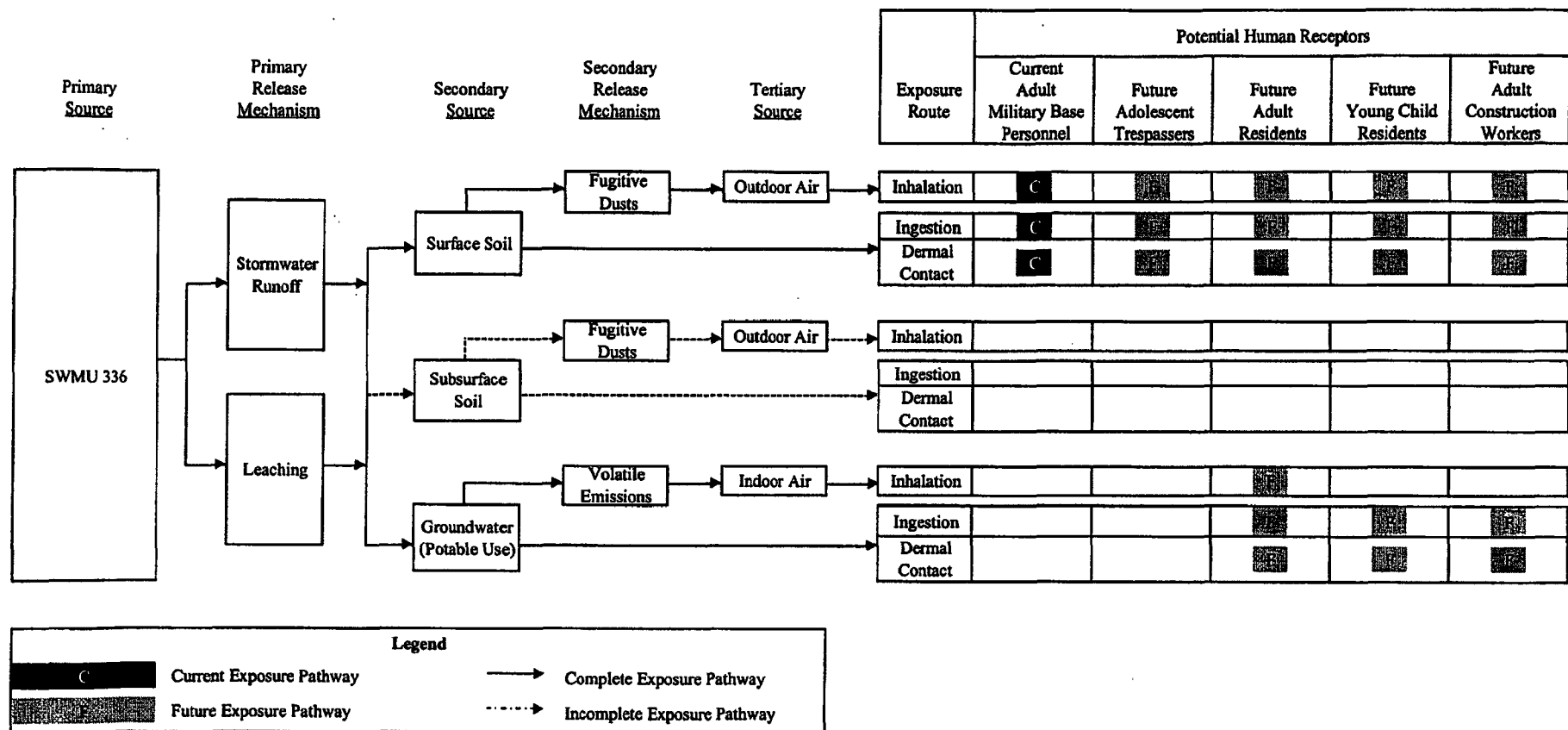
Analyte	USEPA Region IV Recommended Surface Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference ⁽²⁾	Comment
Semivolatile Organics (Cont.):			
2,4-Dichlorophenol	3	Efroymson et. al. 1997	value for total dichlorophenols
2,4-Dimethylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2,4-Dinitrophenol	20,000	Efroymson et. al. 1997	
2,4-Dinitrotoluene	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2,6-Dinitrotoluene	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Chloronaphthalene	1000	MHSPE 1994	value for chloronaphthalene
2-Chlorophenol	2.5	MHSPE 1994	value for total monochlorophenols
2-Methylnaphthalene	NA	--	
2-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Nitrophenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
3,3'-Dichlorobenzidine	100	Beyer 1990	value for total polycyclic chlorinated hydrocarbons
3-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4,6-Dinitro-2-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Bromophenyl-Phenylether	NA	--	
4-Chloro-3-Methylphenol	2.5	MHSPE 1994	value for total monochlorophenols
4-Chloroaniline	NA	--	
4-Chlorophenyl-Phenylether	100	Beyer 1990	value for total polycyclic chlorinated hydrocarbons
4-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Nitrophenol	7,000	Efroymson et. al. 1997	
Acenaphthene	20,000	Efroymson et. al. 1997	
Acenaphthylene	NA	--	
Acetophenone	NA	--	
Anthracene	100	Beyer 1990	
Atrazine	NA	--	
Benzaldehyde	NA	--	
Benzo(a)anthracene	NA	--	
Benzo(a)pyrene	100	Beyer 1990	
Benzo(b)fluoranthene	NA	--	
Benzo(g,h,i)perylene	NA	--	
Benzo(k)fluoranthene	NA	--	
bis(2-Chloroethyl)ether	NA	--	
bis(2-Chloroethoxy)methane	NA	--	
bis(2-Ethylhexyl)phthalate	NA	--	see value for total phthalates
Butylbenzylphthalate	NA	--	see value for total phthalates
Caprolactam	NA	--	
Carbazole	NA	--	
Chrysene	NA	--	
Dibenzo(a,h)anthracene	NA	--	
Dibenzofuran	NA	--	
Diethylphthalate	100,000	Efroymson et. al. 1997	
Dimethylphthalate	200,000	Efroymson et. al. 1997	
Di-n-butylphthalate	200,000	Efroymson et. al. 1997	
Di-n-octylphthalate	NA	--	
Fluoranthene	100	Beyer 1990	
Fluorene	30,000	Efroymson et. al. 1997	
Hexachlorobenzene	2.5	MHSPE 1994	
Hexachlorobutadiene	NA	--	
Hexachlorocyclopentadiene	10,000	Efroymson et. al. 1997	
Hexachloroethane	NA	--	
Indeno(1,2,3-cd)pyrene	NA	--	
Isophorone	NA	--	
Naphthalene	100	Beyer 1990	
Nitrobenzene	40,000	Efroymson et. al. 1997	

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FIGURES

FIGURE 6-1
FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA



7.0 ECOLOGICAL RISK ASSESSMENT

The overall purpose of an ecological risk assessment (ERA) is to evaluate the likelihood that adverse ecological effects would occur or are occurring as a result of exposure to one or more physical or chemical stressors. The assessment evaluates the potential effects of chemicals on terrestrial and aquatic receptors (e.g., flora and fauna) and their habitats, including the consideration of protected species and sensitive or critical habitats, and identifies particular chemical stressors that may cause adverse effects (ecological Chemicals of Potential Concern [COPCs]).

Because no risk assessment guidance has been developed specifically for the Resource Conservation and Recovery Act (RCRA) program, guidance designed for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites was followed (USEPA, 1996). The following guidance documents were consulted during the risk assessment process:

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. USEPA 1997a.
- Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment. USEPA 2001. Originally published November 1995. Website version last updated November 30, 2001 <<http://www.epa.gov/region4/waste/ots/ecolbul.htm>>
- Amended Guidance on Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders. USEPA Region IV, Memorandum 4WD-OTS, 2000 (USEPA 2000b).
- Navy Policy for Conducting Ecological Risk Assessments. Chief of Naval Operations (CNO) 1999.
- Guidelines for Performing Screening Level Ecological Risk Assessments Within the North Carolina Division of Waste Management, North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management. October 2003 (NCDENR 2003b).

This section of the RFI presents a screening level ERA and Step 3a of the baseline ERA. The screening level ERA is organized into the following components (NCDENR 2003b):

Step 1: Preliminary Problem Formulation and Ecological Effects Evaluation. This step is designed to help answer the question "Is there an ecology here to protect?"

- Ecological Setting
- Fate and Transport Mechanisms
- Potentially Complete Exposure Pathways

Step 2: Preliminary Exposure Estimate and Risk Calculation. This step is designed to help answer the question "Are risks to ecological receptors present at the site?"

- Data Collection and Evaluation

- Abiotic Screen
- Uncertainty and Data Gaps
- Scientific/Management Decision Point
- Screening-Level ERA Summary

The Navy ERA process consists of eight steps organized into three tiers and represents a clarification and interpretation of the eight-step ERA process (CNO 1999). Under Navy policy, if the results of Step 1 and Step 2 (Tier 1 screening level ERA) indicate that, based on a set of conservative exposure assumptions, there are chemicals present in environmental media that may present a risk to receptor species/communities, the ERA process proceeds to the baseline ERA. According to Superfund guidance (USEPA, 1997a), Step 3 represents the problem formulation phase of the baseline ERA. Under Navy policy, the baseline ERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a. Step 3a precedes the baseline risk assessment problem formulation (Step 3b). In Step 3a, the conservative exposure assumptions applied in Tier 1 are refined and risk estimates are recalculated using the same conceptual site model. The evaluation of risks in Step 3a may also include consideration of background data, chemical bioavailability, and the frequency of detection. If the re-evaluation of the conservative exposure assumptions supports an acceptable risk determination, the site may exit the ERA process.

Step 3a: Refining the List of Chemicals of Potential Concern

- Refinement of Exposure and Effects Level Estimates
- Additional Considerations
- Uncertainty Associated with Step 3a
- Step 3a Summary

It should be noted that Step 3a is only conducted if it is determined that potential ecological effects are possible based on the results of Steps 1 and 2. The conclusion of the screening level ERA and Step 3a (if applicable) will be one of the following (NCDENR 2003b):

- There is adequate information to conclude that the ecological risks are negligible
- The site has inadequate data to complete the risk characterization. Large data gaps need to be filled prior to completion of the screening process.
- The information indicates a potential for adverse ecological effects and a more thorough assessment is warranted.

The following sections describe the general technical approach and results of the risk evaluation at Solid Waste Management Unit (SWMU) 336.

7.1 Step 1 – Preliminary Problem Formulation and Ecological Effects Evaluation

Screening-level problem formulation concerns the development of a preliminary conceptual model for the site that includes a description of the ecological setting including discussion of contaminants known or suspected to exist at the site and potential contaminant fate and transport mechanisms, and the identification of potentially complete exposure pathways (USEPA 1997a). Information gathered as part of Step 1 of the screening level ERA is used to answer the question: "Is there an ecology here to protect?"

7.1.1 Ecological Setting

An understanding of the ecological setting of the site is an important component of the screening level ERA. A discussion of the ecological setting generally includes a description of facility operations, the regional ecological setting, and the site-specific ecological setting. A detailed description of Marine Corps Base (MCB), Camp Lejeune, including the history and mission of the base, a summary of hazardous wastes generated, and detailed information regarding the regional ecological setting, including topography and surface features, surface water hydrology, geology, hydrogeology, land use and demographics, climatology, water supply, ecological characteristics, wetlands, and threatened and endangered species information is provided in Section 2.0 of the Phase II Confirmatory Site Inspection (CSI) Report (Baker 2002). Information on the site-specific ecological setting is provided in the following paragraphs.

The ecological setting of SWMU 336 was evaluated via examination of historical information and a site visit conducted by a certified ecologist on 16 February 2005. During the site visit, which lasted approximately one-half hour, the Checklist for Ecological Assessments/Sampling (Appendix A, NCDENR 2003b) was completed. This checklist, including photographs of the site taken during the site visit, is presented as Appendix I.

SWMU 336 consists of a pair of former paint stripping vats located in a separate room within Building AS-4106 at Marine Corps Air Station (MCAS) New River. The floor beneath the vats is concrete with two floor drains located on either side of the vats. These drains exit the northwest side of the building near a red access door (Photo 1 in Appendix I). The paint stripping vats have been removed and a new paint stripper has been installed and in use. This new stripper is an upgraded unit making potential releases less likely.

SWMU 336 is located in the middle of a highly industrialized area of the Base, adjacent to the airfield. Access (to humans and larger bodied upper trophic level receptors) is restricted by fencing that secures the airfield. Terrestrial habitat in the study area is limited to a narrow stretch of maintained lawn, which extends approximately 25 feet out from the building and stretches past the length of the building (100 feet; total grass area >2500 square feet = 0.06 acres). The surrounding area is covered by buildings, cement, or asphalt. Views of the site from the red access door are provided as Photos 2, 3, and 4 in Appendix I. The lawn area consists of a mix of grasses and herbaceous species (Photo 5 in Appendix I). The presence of terrestrial invertebrates in the lawn area is anticipated to be minimal due to the widespread use of pesticides around Base buildings. However, because no documentation of pesticide use in the site area is available, invertebrates are assumed to have the potential to inhabit this area. No small mammals or other animals were observed during the site visit. Based on the distance to habitat that would be suitable for dwelling (rather than just foraging), it is unlikely that such receptors would be present in this area. Avian receptors do have the potential to access the maintained lawn, where they may forage for food items. Figure 7-1 presents an aerial photograph of the study area.

The topography in the study area is flat to gently sloping. The surface elevation at White Street is approximately 24-feet above mean sea level (msl). The surface elevation of the asphalt storage area, to the northwest of AS-4106, is approximately 23.4-feet above msl. A concrete drainage channel is located northwest of the SWMU just southeast of White Street. Surface water tends to drain towards this drainage channel. Direct infiltration of precipitation occurs in the limited grassy areas found along side building AS-4106. There was no evidence of surface runoff or erosion in the study area.

As indicated on Figure 3-5, groundwater at the site flows to the south. The depth to the surficial aquifer at the site is approximately 9 to 14-feet below ground surface (bgs). Groundwater velocity estimates for the surficial aquifer range from 0.005 to 0.086 foot per day (ft/d), with an average of 0.038 ft/d (or 13.87 feet/year) (Section 3.3.2). The hydraulic gradient across the site averages approximately 0.005 feet/foot. No aquatic habitat is present at or adjacent to the SWMU. The nearest downgradient aquatic habitat is the Southwest Creek, located one mile south of the SWMU.

No protected species have been reported or observed at SWMU 336. The site is not located within any areas identified as ecologically protected or of significant natural value. No endangered species were noted during the site visit nor were endangered species referenced at the site during the endangered species survey (LeBlond et al., 1994).

7.1.2 Fate and Transport Mechanisms

A transport pathway describes the mechanisms whereby chemicals may be transported from a source of contamination to ecologically relevant media. Transport pathways for SWMU 336 are illustrated in the preliminary ecological conceptual model (Figure 7-2). As depicted in the preliminary ecological conceptual model, the primary mechanisms for chemical transport from potential source areas are believed to include the following:

- Leaking/spills from underground pipes to surface and subsurface soils.
- Uptake by biota from soil and trophic transfer to upper trophic level receptors.
- Volatile emissions from surface soils and erosion releasing fugitive dusts to the atmosphere.

Although a potentially complete and significant pathway, as per USEPA Region IV Guidance (USEPA, 2000b) the evaluation of chemical transfer to upper trophic level ecological receptors via food chain uptake is beyond the scope of the screening level ERA; therefore, food web exposure modeling is not included in Step 1 or 2 of this document. It should be noted that in many cases, screening values developed by USEPA Region IV and recommended for use by NCDENR (2003b) do consider risks to upper trophic level receptors in addition to lower trophic level receptors when such information is available from the toxicological data. Food web modeling will be included in Step 3a if deemed appropriate based upon the bioavailability, spatial distribution, and detected concentrations of COPCs.

7.1.3 Potentially Complete Exposure Pathways

An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media. Exposure, and thus potential risk, can only occur if each of the following components exists:

- A source and mechanism of chemical release into the environment
- An environmental transport medium
- A point of potential contact between an ecological receptor and the medium
- A feasible exposure route at the contact point

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are direct

uptake, dermal contact, ingestion, and inhalation. Because SWMU 336 is not adjacent to an aquatic habitat, potential exposure to aquatic receptors is not addressed in the following paragraphs.

Terrestrial plants may be exposed to chemicals present in surface soils through their root surfaces during water and nutrient uptake. Terrestrial invertebrates may be exposed to chemicals in soil through dermal adsorption and ingestion. Much of the toxicological data available for terrestrial invertebrates are based upon *in situ* studies that represent both adsorption and ingestion pathways; therefore, both pathways are considered together in the risk evaluation.

Upper trophic level receptors may be exposed to chemicals through: (1) the inhalation of gaseous chemicals or chemicals adhered to particulate matter; (2) the incidental ingestion of contaminated abiotic media (e.g., soil) during feeding or cleaning activities; (3) the ingestion of contaminated water; (4) the ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These exposure routes (with the exception of the inhalation route) are depicted on Figure 7-2. Their relative importance depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate, the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate (e.g., aluminum), the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of abiotic media, such as soil or sediment.

For upper trophic level receptors, certain potential exposure pathways and/or routes (e.g., dermal contact and inhalation), although potentially complete, are considered insignificant relative to other pathways (e.g., ingestion) due to low potential for exposure. The relative insignificance of the dermal exposure pathway is supported by evidence outlined in Suter II et al. (2000) and USEPA (2000c), the low potential exposure frequency and duration, and the protection offered by feathers, fur, and scales to avian, mammalian, and reptilian receptors, respectively. Literature reviews indicate that dermal exposures to wildlife from classes of chemicals known or suspected to be of concern via dermal adsorption (volatile organic compounds [VOCs], organophosphate pesticides, and petroleum compounds) are often overestimated in laboratory studies (where feathers/fur are removed) and do not represent realistic exposure scenarios (USEPA, 2000c). Moreover, in developing soil screening levels for 24 important compounds identified from National Priorities List (NPL) sites and Biological Technical Assistant Group (BTAG) recommendations, USEPA calculated that the contribution of dermal exposures to the total dose received by terrestrial receptors to be 0.5 percent or less and therefore omitted the dermal pathway from in their exposure estimates (USEPA, 2000c).

Inhalation of gaseous chemicals and chemicals adhered to particulate matter (e.g., soil) is also considered insignificant relative to ingestion pathways. As described above for dermal exposures, this approach is consistent with Suter II et al. (2000) and USEPA (1997b and 2000c), which recognize the relatively small contribution the inhalation pathway contributes to exposure estimates. For example, USEPA (2000c) estimates the expected contribution of exposure to dust particles and VOCs via inhalation to be 0.01 percent and 0.5 percent or less, respectively relative to ingestion. When present, vegetative groundcover and litter layers further minimize suspension of dust and the potential for inhalation exposures to chemicals adhered to particulate matter.

A discussion of potential complete exposure pathways for ecological receptors at SWMU 336 is presented below. Specific pathways addressed by the screening level ERA are also identified.

Groundwater Exposure Pathway. The potential release sources for the groundwater exposure pathway are surface and subsurface soils that may have been contaminated as a result of leaks or spills at the site. Release mechanisms are leaching/desorption of chemicals to subsurface soil and vertical migration with infiltrating precipitation to groundwater (or leaching/desorption directly to groundwater).

Although groundwater is not inhabited by ecological receptors, receptors may potentially be exposed to chemicals in groundwater if the chemicals migrate to surface water and/ or sediment. Based on groundwater contours (see Section 3), groundwater flow direction in the surficial aquifer is to the south. The nearest downgradient aquatic habitat is Southwest Creek, which is located one mile south of the SWMU. The nature and extent of contamination at this site has been defined and is limited to the immediate site vicinity. There is no evidence that site contamination is reaching any aquatic habitat or being released to the ground surface via a groundwater seep. Based upon these considerations, the groundwater exposure pathway for SWMU 336 is incomplete and is not evaluated further in this ERA.

Soil Exposure Pathway. The release source for the subsurface and surface soil exposure pathway is material that was introduced into the floor drains and may have leaked from the underground pipes, or material that may have been spilled at the site. Chemicals may remain in site soils or migrate via surface runoff and fugitive dust emissions. Due to the flat topography of the site, surface runoff is likely to be minimal. The potential for contaminant migration via fugitive dust emissions is addressed in the air exposure pathway.

Subsurface soil is not considered a complete exposure pathway for terrestrial receptors for the following reasons (Suter 1995):

- The mass of most root systems, including grasses and herbaceous species, is within the surface soil
- Most soil heterotrophic activity is within the surface organic layer
- Soil invertebrates occur on the surface or within the oxidized root zone

Air Exposure Pathway. Contaminated surface soil may serve as a release source for the air exposure pathway (fugitive dust emissions from wind erosion). In addition to this release mechanism, volatilization of chemicals from surface soil may occur. Terrestrial mammals, birds, amphibians, and reptiles may be exposed to chemicals in fugitive dust emissions through inhalation. The air exposure pathway is not considered a significant exposure pathway at this SWMU for a number of reasons. Because the nature of the potential contaminant source at the site is an indoor paint-stripping vat, spills would be restricted to the indoor environment. Potential leaks or spills from underground piping leading away from the building would result in contamination below the ground surface. Although such contamination could move into surface soils via capillary action, the maintained lawn that is present in unpaved portions of SWMU 336 minimizes the volatilization of chemicals from soils and the release of fugitive dusts. Furthermore, exposure to contaminants via the inhalation exposure pathway is considered insignificant relative to exposure via the ingestion pathway. For these reasons, the air exposure pathway is considered insignificant and is not evaluated in this risk assessment. It is noted that this pathway is not indicated in the ecological conceptual model.

7.1.4 Conclusions of Step 1

Step 1 of the screening level ERA posed the question "Is there ecology here to protect?" Based on information regarding the ecological setting of the site, fate and transport mechanisms, and potentially complete exposure pathways, which are discussed in the preceding sections, there is a

maintained lawn area at the site that serves as habitat for terrestrial flora and may also serve as habitat for terrestrial fauna. The use of the lawn for foraging by flightless upper trophic level receptors is anticipated to be minimal due to the industrial nature of the site and surrounding area. Avian receptors may use the site for foraging as access to the site is not restricted for such species.

7.2 Step 2 - Preliminary Exposure Estimate and Risk Calculation

Step 2 of the ERA process consists of the preliminary exposure estimate and risk calculation. The following sections describe the data available for the preliminary exposure estimate, and the methods and results of the abiotic screen.

7.2.1 Data Used in the Screening Level ERA

Surface soil data available for the screening level ERA at SWMU 336 include two samples collected from temporary well borings in March 2002, four samples collected from temporary well borings in June 2003, and three samples collected from soil borings in February 2005. Each of these samples was collected from 0 to 1 foot bgs. Of the available surface soil data, four samples were collected from areas of the site topped with asphalt or concrete, and were excluded from the ERA evaluation because such samples are not representative of suitable terrestrial habitat. As a result, data evaluated in the ERA included a total of five surface soil samples. Each of the samples (SWMU336-TW01-00, SWMU336-TW02-00, SWMU336-TW03-00, SWMU336-TW05-00 and SWMU336-TW06-00) were analyzed for VOCs and RCRA metals. Samples SWMU336-TW01-00 and SWMU336-TW02-00 were additionally analyzed for semivolatile organic compounds (SVOCs). Data evaluated in the ERA are summarized in Appendix J.

The available surface soil data did not include duplicate analyses. All samples included in the ERA evaluation were collected in 2002 or 2003 and were analyzed by a fixed base laboratory.

7.2.2 Abiotic Screen

The screening-level exposure estimate and risk calculation provides a highly conservative evaluation of potential ecological risks at a site. Although upper trophic level receptors (e.g., birds) may be identified as potential receptors at the site, the screening level ERA is limited to a comparison of analytical data to media-specific screening values. Screening values used in the screening level ERA are those provided in the NCDENR screening level ERA Guidance (2003b) and are consistent with ecological screening values established by USEPA Region IV (USEPA 2001). The sections that follow describe the various criteria and toxicological benchmarks used as screening values (toxicological thresholds) for chemicals analyzed in surface soil. USEPA Region IV chemical-specific soil screening values are summarized on Table 7-1. The screening values represent conservative exposure thresholds above which adverse ecological effects may occur.

7.2.2.1 Soil Screening Values

Soil screening values used in this evaluation were obtained from the NCDENR Guidelines for performing screening level ERAs (NCDENR 2003b). The recommended soil screening values presented by NCDENR are consistent with values recommended by USEPA Region 4 in the Ecological Risk Assessment Bulletins. The original sources for these values include the following: Beyer (1990), Efroymson et al. (1997a), Efroymson et al. (1997b), Canadian Council

of Ministers of the Environment ([CCME] 1997), the Dutch Ministry of Housing, Spatial Planning and Environment (MHSPE) (1994), and Crommentuijn et al. (1997).

7.2.2.2 Hazard Quotient Calculation

A hazard quotient (HQ) was calculated for each chemical by dividing the maximum exposure concentration of the chemical by USEPA Region IV ecological screening value for that chemical:

$$\text{Hazard Quotient} = \frac{\text{Maximum Exposure Concentration}}{\text{Screening Value}}$$

The maximum exposure concentration is estimated as the maximum detected concentration of the chemical or, in cases where the chemical was not detected in a given media, the maximum sample detection limit (MDL) (NCDENR 2003b). HQs exceeding 1.0 indicate the potential for risk since the estimated exposure exceeds the estimated effects concentration. However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than one do not necessarily indicate that risks are present or impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs that are equal to or less than one indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

Chemicals were identified as COPCs if they fell in to one or more of the following categories (NCDENR 2003b):

- Category 1 – Chemicals whose maximum detection exceeds the USEPA Region IV media specific ecological screening value (HQ > 1.0; chemical detected).
- Category 2 – Chemicals that were not detected in any samples for a given media, but for which the MDL exceeded the USEPA Region IV media specific ecological screening value (HQ > 1.0; chemical not detected).
- Category 3 – Chemicals that have no USEPA Region IV ecological screening value but were detected above the laboratory sample quantitation level (SQL) (No screening value; chemical detected).
- Category 4 – Chemicals that were not detected above the laboratory SQL and have no USEPA Region IV ecological screening value (No screening value; chemical not detected).

Any tentatively identified compounds or unknown chemicals present at the site would have been identified as preliminary COPCs and included as Category 3 contaminants; however, no such chemicals were present at SWMU 336. Chemicals that did not fall in to one of the contaminant categories were not identified as COPCs and were not evaluated further.

7.2.2.3 Results of the Abiotic Screen

The results of the abiotic screen for surface soil are presented in the following paragraphs. Chemicals identified as ecological COPCs based on the abiotic screen proceed to Step 3a of the ERA (Section 7.3).

Five surface soil samples (0 to 1-foot bgs) were collected and analyzed for VOCs and RCRA metals. Two of the samples were additionally analyzed for SVOCs. Table 7-2 presents HQ calculations for surface soil. Sixty-eight chemicals were identified as ecological COPCs in surface soils. Two RCRA metals (cadmium and chromium) were identified as Category 1

COPCs because maximum detected concentrations exceeded surface soil screening values. HQs for Category 1 metals were 2.75 (for cadmium) and 38.25 (for chromium), indicating that unacceptable risks may be occurring. Concentrations of both metals in excess of USEPA Region IV soil screening values were limited to locations SWMU336-TW01 and SWMU336-TW02.

Four VOCs and 13 SVOCs were not detected but were identified as Category 2 COPCs because their MDL exceeded surface soil screening values. HQs for Category 2 COPCs ranged from 1.20 (for two VOCs) to 8,000 (for atrazine).

One VOC (acetone) and three SVOCs (bis[2-ethylhexyl]phthalate, butylbenzylphthalate, and di-n-octylphthalate) were identified as ecological COPCs in Category 3 because they were detected in surface soils but lacked USEPA Region IV soil screening criteria.

Finally, 13 VOCs and 33 SVOCs were identified as Category 4 COPCs because they were not detected and are lacking soil screening values.

7.2.3 Uncertainties Associated with the Screening Level ERA

The procedures used in this evaluation to assess risks to ecological receptors, as in all such assessments, are subject to uncertainties because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. Uncertainties associated with the screening level ERA for SWMU 336 and their effects on risk conclusions are presented and discussed below.

Identification of Ecological COPCs

- There is uncertainty regarding potential risk that may be contributed by chemicals that were identified as COPCs but were not detected in site media (Category 2 and Category 4 COPCs). It is as likely that the concentrations of these chemicals at the SWMU are at or near zero and that they are not present in ecologically harmful concentrations. The identification of such chemicals as COPCs is a conservative measure designed to be highly protective, but is likely to overestimate the potential for adverse effects.
- There is also uncertainty regarding the potential risk that may be contributed by chemicals that lack soil screening values (Category 3 and Category 4 COPCs). Because toxicological data regarding the potential effects of such chemicals on ecological receptors is lacking, it is not possible to quantitatively evaluate risks to ecological receptors. The identification of such chemicals as COPCs is a highly conservative approach aimed at preventing the elimination of compounds that could have harmful impacts on the environment from the list of COPCs. Although this approach is conservative, the absence of toxicological data on these chemicals adds uncertainty to the conclusions of the risk assessment and may lead to an underestimation or overestimation of potential ecological impacts contributed by the SWMU. This uncertainty is reduced in Step 3a of the baseline ERA through the introduction of additional available toxicological data from the literature for those chemicals lacking Region IV ecological screening values.
- Each of the VOCs and SVOCs detected in surface soil (acetone, methylene chloride, toluene, and the phthalate esters) are known to be common laboratory contaminants (USEPA 1989). While validation of the data removes uncertainty involving laboratory

contamination, there is the possibility that detections of such compounds in site media reflect laboratory conditions and not site conditions.

Exposure Point Concentrations

- As is typical in a screening level ERA, a finite number of samples of abiotic media are used to develop the exposure estimates. The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based on the mean chemical concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the Wildlife Exposure Factors Handbook (USEPA 1993), which specify the use of average media concentrations. The use of mean concentrations to estimate exposure in a refinement (Step 3a of the baseline ERA) is more likely to provide a more accurate picture of potential risks at the site.

Media-specific Screening Values

- Potential adverse impacts to terrestrial flora and fauna were evaluated by comparing the detected compound concentrations to surface soil screening values. Screening values may not take into account soil type, which may have a great influence on the toxicity of the chemicals. For example, soil with high organic carbon content will tend to absorb many of the organic compounds, thus making them less bioavailable to terrestrial receptors. Some screening values can be developed based on both field and growth chamber studies; therefore, the reported toxic concentrations are not always equivalent to actual field conditions. In addition, some screening values may be calculated based on a low number of studies or may have only examined toxicities to a limited diversity of invertebrate species.
- Screening values for some chemicals are based on background soil concentrations and not on toxicological studies. The use of these values may overestimate risks at the site.
- In the case of chromium, to be conservative, screening levels were estimated from the chromium VI form of the element. Chromium III, which is orders of magnitude less toxic than chromium VI, is most likely to be the predominant form in the environment.
- The species used to develop the screening values may not be present at the site or in nearby areas, or have the potential to exist in these areas. Depending on the sensitivity of the tested species relative to that of the species at or near the site, use of the toxicity values may overestimate or underestimate risk.

Chemical Mixtures

- Information on the ecotoxicological effects of chemical interactions is generally lacking, which required (as is standard for ecological risk assessments) that the chemicals be evaluated on a compound-by-compound basis during the comparison to screening values. This could result in an underestimation of risk (if there are additive or synergistic effects among chemicals) or an overestimation of risks (if there are antagonistic effects among chemicals).

Bioaccumulative Chemicals

- Many of the chemicals identified as ecological COPCS at SWMU 336 have been identified as important bioaccumulative chemicals by the USEPA (2000a). There is some potential that bioaccumulative chemicals may pose unacceptable risks to upper trophic level receptors even if no unacceptable risk is posed to primary receptors. Because ecological screening values are often based on toxicological studies of primary receptors (e.g., terrestrial plants and invertebrates), the abiotic screen alone may underestimate the number of COPCs at the SWMU. An evaluation of risks to upper trophic level receptors is beyond the scope of the screening level ERA. The bioaccumulative potential of individual chemicals is considered in Step 3a of the baseline ERA when determining the need for further evaluation.

7.3 Step 3a – Refining the List of Chemicals of Potential Concern

The screening level ERA for SWMU 336 indicated that, based on a set of conservative exposure assumptions, there are multiple chemicals that may present a risk to ecological receptors in the maintained lawn adjacent to the site. Therefore, SWMU 336 was carried in to Step 3a of the ERA process. In Step 3a, the ecological COPCs identified in Step 2 are further evaluated to determine which chemicals, if any, can be removed from further ecological consideration. The Step 3a evaluation examines multiple factors that improve the realism of the risk evaluation while remaining protective of the environment. These factors include consideration of population-level effects, use of alternative screening values, an evaluation of background data, consideration of the frequency and distribution of detections, consideration of bioavailability, dilution, and natural attenuation, and any chemical or site-specific considerations that may be relevant. These factors were used to weigh the evidence of potential risk for each COPC identified for each media to assess whether the COPC should be carried in to Step 3b of the baseline ERA. The specific assumptions and methods that were modified for Step 3a are identified below, along with justification for each modification. If re-evaluation of the conservative exposure assumptions supports an acceptable risk determination then the site may exit the ecological risk assessment process (USEPA 1997a, CNO 1999).

7.3.1 Refinement of Exposure and Effects Level Estimates

During Steps 1 and 2, maximum chemical concentrations of detected chemicals were used as conservative estimates of receptor exposure to calculate HQs. Because many of the receptors evaluated are relatively immobile or have a limited home range, individuals are more likely to be impacted by locations of maximum concentration; however, average contaminant concentrations are more appropriate for evaluating impacts to *populations* of soil invertebrates. Arithmetic means were calculated for all compounds identified as COPCs in the screening level ERA. For COPCs detected in less than 100 percent of the samples collected, arithmetic means were calculated using one half the detection limit of non-detected samples. These means were used to estimate the exposure of ecological receptors to site contaminants. If the arithmetic mean for a given chemical was greater than the maximum detected concentration, the maximum detected concentration was used as the exposure estimate.

Effect levels used in Steps 1 and 2 were NCDENR media screening values. In Step 3a, screening values were introduced, when available, for chemicals that did not have screening values established by NCDENR. All screening values used in Step 3a are provided on Table 7-3. Screening values that were introduced for Step 3a are shaded on the table. Introduced screening values included those established by NCDENR for chemical classes (e.g., the screening value for

total PAHs is applied to individual PAHs), and USEPA Region V soil ecological screening values for RCRA hazardous constituents (USEPA 2003).

A mean HQ was calculated for each COPC using the refined estimates of exposure and effects. Chemicals with mean HQs less than or equal to one are unlikely to pose unacceptable risks to populations of ecological receptors. In most cases, such chemicals were not considered to be risk-driving COPCs and were not recommended for further ecological evaluation. However, prior to removing a chemical from further consideration, the maximum HQ and spatial distribution of exceedences were evaluated to identify any potential hot spots of contamination that may be driving unacceptable risk. Only if no hot spots were identified was a mean HQ less than one used as a sole criterion for eliminating a COPC from further consideration.

Results of the refinement of exposure assumptions for surface soil are summarized on Table 7-4. The comment column of this table indicates those chemicals with a mean HQ less than or equal to 1.0.

7.3.2 Comparison to Background Data

Inorganic constituents in surface soil that were selected as COPCs based on the screening level ERA were compared to background data. Surface soil background data were obtained from the Final Area of Concern Background Study (Baker 2001). SWMU-specific background concentrations were established using protocol outlined in Ohio Environmental Protection Agency's (OEPA's) Closure Plan Review Guidance for RCRA Facilities (OEPA, 1999). NCDENR agreed that SWMUs could be grouped together into areas of concern (AOCs) based on geographical location, geology and type of SWMU, and that background concentrations for metals could be established for each of these AOCs. These background data are to be evaluated in comparison to the levels of inorganic constituents detected at individual SWMUs to assess whether the presence of such constituents is naturally occurring or may be attributed to activities (past and/or present) within the AOCs. Surface and subsurface soil samples were collected from eleven AOCs. Surface soil samples were collected from 0 to 1 foot bgs, and subsurface soil samples were collected from just above the water table. All soil samples were analyzed for TAL metals, TOC, and pH. SWMU 336 is included within AOC 2, therefore, surface soil data from SWMU 336 are compared to the AOC 2 background data set. The complete set of background data collected for each AOC is presented in the AOC Background Study.

In accordance with USEPA Region 4 Human Health Risk Assessment Bulletins, Supplement to RAGS, maximum site concentrations were compared to two times the base background mean (USEPA, 2000d). The comparison is useful for determining whether or not the presence of chemicals at the site should be considered site related or may be considered naturally occurring. Inorganic constituents with background concentrations (two times the mean) that exceed maximum site concentrations are not considered risk-driving COPCs and are not recommended for further evaluation. Organic compounds were not analyzed as part of the AOC Background Study.

Table 7-4 presents background data and results of comparisons to maximum soil concentrations at SWMU 336. The comment column of this table indicates those chemicals for which maximum site concentrations were less than twice the mean background concentration with the comment "< Background."

7.3.3 Frequency and Distribution of Detections

Chemicals not detected in any environmental samples are unlikely to be present in sufficient volume to contribute significant risks to receptors at a site, especially at the population level. Those COPCs that were not detected were removed from further consideration and are indicated on Tables 7-4 by the comment "Not Detected." The magnitude and frequency with which sample quantitation limits exceeded screening values and the likelihood for a chemical to be site-related, even if not detected, were considered prior to removing a chemical from further consideration based on detection frequency.

It should be noted that chemicals detected infrequently may also be removed from further consideration after evaluation of a variety of factors including the distribution of detections, the magnitude of potential risks, and the site history and presence or absence of chemical precursors in any site media. When appropriate, a discussion of such chemicals is included in the text.

7.3.4 Considerations of Bioaccumulative Potential

The USEPA has identified certain chemicals as "important bioaccumulative chemicals" (USEPA 2000a). Bioaccumulative chemicals may pose unacceptable risks to upper trophic level receptors even if no unacceptable risk is posed to primary receptors. Although an evaluation of risks to upper trophic level receptors is not included in the screening level ERA, consideration of the bioaccumulative potential of each COPC will be made before determining the need for additional evaluation of a particular chemical. Those chemicals identified as important bioaccumulative chemicals by the USEPA are indicated in the third column from the right on Table 7-4.

7.3.5 Additional Considerations

Additional factors that were considered when determining the need for further evaluation of an ecological COPC include but are not limited to the following:

- For chemicals lacking screening values, comparison to range of available screening values for chemicals in the same chemical class.
- For chemicals with screening values not based on toxicological studies, consideration of toxicological-based screening values from the scientific literature.

Chemical specific considerations for surface soil COPCs are addressed in the following sections.

7.3.5.1 Surface Soil COPCs

The SVOCs bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-octylphthalate were identified as a Category 3 COPCs in Step 2 of the screening level ERA because they were detected in surface soils and lacked USEPA Region IV soil screening values. The screening value listed on Table 7-3 for each of these chemicals (100 microgram per kilogram [ug/kg]) was provided by NCDENR to screen total phthalates; maximum detected concentrations of bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-octylphthalate exceeded this value. The original source of the 100 ug/kg screening value is a Dutch soil screening benchmark (MHSPE, 1994). This screening value represents background concentrations, and is not based on toxicological data; therefore, it may not be representative of effects-based concentrations. For this reason, an additional search for toxicity-based benchmarks was conducted for each of the three phthalates under consideration.

USEPA Region V (USEPA, 2003) has developed screening values for RCRA hazardous materials, including a value of 925 ug/kg for bis(2-ethylhexyl)phthalate. This screening value is based on toxicity to the masked shrew (*Sorex cinereus*) (USEPA 2003). Bis(2-ethylhexyl)phthalate was detected in each of the two Phase II surface soil samples. Sample SWMU336-TW01-00 had a concentration of 860 ug/kg, and sample SWMU336-TW02-00 had a concentration of 100J ug/kg. Both detections at the SWMU were less than the Region V benchmark. A search of the primary literature on the toxicological effects of bis(2-ethylhexyl)phthalate to soil flora and fauna yielded a single study. Neuhauser et al. (1985) investigated the toxic effect of bis(2-ethylhexyl)phthalate on *Lactuca sativa* (lettuce) growth in a natural soil (1.4 percent TOC). After 14-days of exposure, lettuce growth (biomass) was not affected by the single concentration tested (1,000,000 ug/kg). Application of a conservative safety factor of 100 yields an estimated chronic NOAEL equal to 10,000 ug/kg. Given each of the detected concentrations of bis(2-ethylhexyl)phthalate in SWMU 336 surface soil is less than the toxicologically based USEPA Region V screening value and the NOAEL estimated from data reported by Neuhauser et al. (1985), bis(2-ethylhexyl)phthalate is not identified as a potential ecological risk driver, and no additional evaluation is recommended.

USEPA Region V developed a screening value of 239 ug/kg for butylbenzylphthalate (based on toxicity to the masked shrew; USEPA 2003). Butylbenzylphthalate was detected in one sample (SWMU336-TW01-00) at 860 ug/kg, which exceeds the Region V screening value. No additional toxicological data on butylbenzylphthalate was found in a search of the primary literature. The location-specific HQ for butylbenzylphthalate at SWMU336-TW01-00 is 3.60, indicating a low potential for adverse effects to receptors at this location. Butylbenzylphthalate was not detected in any other Phase II surface samples, which were located in areas that were most likely to be contaminated, and was not analyzed for in the RFI samples. The second Phase II sample was located approximately 15 feet from SWMU336-TW01-00. The absence of butylbenzylphthalate in this soil sample suggests that contamination is spatially limited to the immediate vicinity of SWMU336-TW01-00. Based on the relatively low HQ at the area of the site most likely to be contaminated, and the limited spatial extent of contamination, butylbenzylphthalate is not identified as an ecological risk driver, and no further evaluation is recommended.

USEPA Region V developed a screening value of 709,000 ug/kg for di-n-octylphthalate (based on toxicity to the masked shrew; USEPA 2003). Di-n-octylphthalate was detected in one sample (SWMU336-TW01-00) at 110J ug/kg, which is three orders of magnitude less than the Region V screening value. No additional toxicological data on di-n-octylphthalate was found in a search of the primary literature. Because the sole detection of di-n-octylphthalate at SWMU 336 was less than the toxicity-based Region V screening value, this phthalate is not considered an ecological risk driver and no further evaluation is recommended.

Cadmium was identified as a Category 1 COPC in the screening level ERA because the maximum detected concentration (4.4 milligram per kilogram [mg/kg] in SWMU336-TW02-00) exceeded the USEPA Region IV screening value of 1.6 mg/kg. The mean concentration of cadmium at the site (1.42 mg/kg) was less than this screening value, indicating acceptable risk to populations of ecological receptors that may forage at the site. As a conservative measure, the spatial distribution of cadmium concentrations in excess of the soil screening value was evaluated. Cadmium concentrations exceeded the soil screening value at two locations; in addition to the maximum detected concentration, the concentration of cadmium in sample SWMU336-TW01-00 (1.8 mg/kg) just exceeded the screening value. Based on the limited spatial distribution of exceedences, the relatively low maximum HQ (2.75) indicating a low

potential for adverse ecological effects, and a mean HQ indicating acceptable site-wide risks, cadmium is not identified as an ecological risk driver and no further evaluation is recommended.

Chromium was identified as a Category 1 COPC in the screening level ERA because the maximum detected concentration exceeded the surface soil screening value (0.4 mg/kg). Two sample locations had chromium concentrations in excess of the screening value: location SWMU336-TW01-00 (13.8 mg/kg) and SWMU336-TW02-00 (15.3 mg/kg). Although both detected chromium concentrations at SWMU 311 exceeded two times the mean background concentration from AOC 2 (12.68 mg/kg; Table 7-4), the site detections were very close to the maximum background detection (range of chromium in AOC 2 background samples = 2.2J to 14.9J mg/kg), and the mean site concentration (5.86 mg/kg) was less than the background mean (6.34 mg/kg). In addition to the USEPA Region IV screening value for chromium, the Federal USEPA has established ecological soil screening levels (Eco-SSLs) for this metal (USEPA 2005). An Eco-SSL of 26 mg/kg (Cr III) was established for avian receptors, while Eco-SSLs of 34 mg/kg (Cr III) and 81 mg/kg (Cr VI) were established for mammalian receptors. Chromium concentrations at SWMU 336 were less than each of these values. Insufficient data were available for the USEPA to establish Eco-SSLs for terrestrial plants or invertebrates; however, USEPA 2005 does provide data from two invertebrate toxicity studies that they consider eligible for Eco-SSL derivation (a minimum of three studies are required to establish an Eco-SSL). In the first study, Van Gestel et al, (1992) identified a MATC of 57 mg/kg for effects on reproduction of the earthworm *Eisenia andrei* in soils with a pH of 6.7. In 1993, the same researchers studied reproductive effects of chromium on *E. andrei* in a soil with a pH of 6.0 and again identified a MATC of 57 mg/kg (Van Gestel et al., 1993). Again, site concentrations of chromium were less than these toxicity-based values. Because chromium concentrations at SWMU 336 were essentially equivalent to background concentrations, and were less than Eco-SSLs established by the USEPA, chromium is not identified as an ecological risk driver and no further evaluation is recommended.

7.4 Risk Characterization

The risk characterization integrates the results of the screening level ERA and Step 3a. The likelihood of adverse effects occurring as a result of exposure to a stressor is evaluated. The ecological significance of the risks characterized at the site is discussed considering the types and magnitudes of the effects and their spatial and temporal patterns. Ecologically significant risks are defined as those potential adverse risks or impacts to ecological integrity that affect populations, communities, and ecosystems, rather than individuals (i.e. measured impacts to individuals does not necessarily indicate impacts to the ecosystem).

Limited terrestrial habitat is present at SWMU 336. This habitat is a maintained lawn area, which is a highly modified low-quality habitat. The lawn may be used by terrestrial flora, fauna, and avian upper trophic level receptors. Of the 75 chemicals identified as ecological COPCs based on Steps 1 and 2 of the screening level ERA, none are recommended for further evaluation based on the results of Step 3a. Surface soils at the SWMU are not indicated to pose unacceptable risks to ecological receptors and no further evaluation is recommended.

7.5 Uncertainties Associated with Step 3a of the Baseline ERA

Many of the uncertainties identified in Section 7.2.3 also apply to the refined screening level risk calculation. Additionally, many uncertainties present in the screening level risk calculation are reduced or eliminated with the Step 3a evaluation. No additional uncertainties have been identified for Step 3a of the baseline ERA at SWMU 336.

7.6 Summary

Limited terrestrial habitat is present at SWMU 336, which may be used by terrestrial flora, fauna, and avian upper trophic level receptors. Of the 75 chemicals identified as ecological COPCs based on Steps 1 and 2 of the screening level ERA, none are recommended for further evaluation based on the results of Step 3a. Surface soils at the SWMU are not indicated to pose unacceptable risks to ecological receptors and no further evaluation is recommended.

No aquatic habitat was present at SWMU 336. The groundwater exposure pathway was evaluated to determine if there was the potential for off-site risk to aquatic receptors via the discharge of contaminated groundwater from the site. This pathway was determined to be incomplete; therefore, no unacceptable ecological risk to aquatic habitat is posed by the SWMU.

7.7 References

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TABLES

TABLE 7-1
ECOLOGICAL SCREENING VALUES
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

Analyte	USEPA Region IV Recommended Surface Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference ⁽²⁾	Comment
Semivolatile Organics (Cont):			
n-Nitroso-di-n-propylamine	NA	--	
n-Nitrosodiphenylamine	20,000	Efroymsen et. al. 1997	
Pentachlorophenol	2	MHSPE 1994	
Phenanthrene	100	Beyer 1990	
Phenol	50	MHSPE 1994	
Pyrene	100	Beyer 1990	
PAHs (total)	1000	Beyer 1990, MHSPE 1994	
Phthalates (total)	100	MHSPE 1994	
Total Inorganics:			
Arsenic	10	Efroymsen et. al. 1997	
Barium	165	Crommentuijn et. al. 1997	
Cadmium	1.6	Crommentuijn et. al. 1997	
Chromium (Total)	0.4	Efroymsen et. al. 1997 and CCME 1997	
Lead	50	Beyer 1990 and Efroymsen et. al. 1997	
Mercury	0.1	Efroymsen et. al. 1997	
Selenium	0.81	Crommentuijn et. al. 1997	
Silver	2	Efroymsen et. al. 1997	

Notes:

NA = Not Applicable/ Not Established

CCME = Canadian Council of Ministers of the Environment

USEPA = United States Environmental Protection Agency

⁽¹⁾ Soil screening values are in microgram per kilogram (ug/kg) for organic compounds and in milligram per kilogram (mg/kg) for inorganic constituents.

⁽²⁾ Values obtained from *Guidelines for Performing Screening Level Ecological Risk Assessments Within the North Carolina Division of Waste Management* (NCDENR 2003); Reference cited shows original reference.

TABLE 7-2
SELECTION OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contaminant Frequency/Range					EPA Region IV ESV	Note	Maximum Hazard Quotient	Soil COPC?	Contaminant Category
	Frequency of Detection	Range of Positive Detections	Location of Maximum Concentration	Range of Detection Limits	Concentration Used For Screening ⁽¹⁾					
Volatile Organic Compounds (ug/kg)										
1,1,1-Trichloroethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
1,1,2,2-Tetrachloroethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
1,1,2-Trichloro-1,2,2-trifluoroethane	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
1,1,2-Trichloroethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
1,1-Dichloroethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
1,1-Dichloroethene	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
1,2,4-Trichlorobenzene	0/5	NA	NA	5U - 12U	12.00	10	value for trichlorobenzene	1.20	Yes	2
1,2-Dibromo-3-chloropropane	0/2	NA	NA	5UJ - 6U	6.00	100	hydrocarbons	0.06	No	
1,2-Dibromoethane	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
1,2-Dichlorobenzene	0/5	NA	NA	5U - 12U	12.00	10	value for dichlorobenzene	1.20	Yes	2
1,2-Dichloroethane	0/5	NA	NA	5U - 12U	12.00	400		0.03	No	
1,2-Dichloropropane	0/5	NA	NA	5U - 12U	12.00	700000		<0.01	No	
1,3-Dichlorobenzene	0/5	NA	NA	5U - 12U	12.00	10	value for dichlorobenzene	1.20	Yes	2
1,4-Dichlorobenzene	0/5	NA	NA	5U - 12U	12.00	10	value for dichlorobenzene	1.20	Yes	2
2-Butanone	0/5	NA	NA	12U - 14U	14.00	NA		NA	Yes	4
2-Hexanone	0/5	NA	NA	12U - 14U	14.00	NA		NA	Yes	4
4-Methyl-2-pentanone	0/5	NA	NA	12U - 14U	14.00	NA		NA	Yes	4
Acetone	2/5	8J - 33	SWMU336-TW01-00	12UJ	33.00	NA		NA	Yes	3
Benzene	0/5	NA	NA	5U - 12U	12.00	50		0.24	No	
Bromodichloromethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Bromoform	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
Bromomethane	0/5	NA	NA	5UJ - 12U	12.00	NA		NA	Yes	4
Carbon disulfide	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
Carbon tetrachloride	0/5	NA	NA	5U - 12U	12.00	1000000		<0.01	No	
Chlorobenzene	0/5	NA	NA	5U - 12U	12.00	50		0.24	No	
Chloroethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Chloroform	0/5	NA	NA	5U - 12U	12.00	1		12.00	Yes	2
Chloromethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
cis-1,2-Dichloroethene	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
cis-1,3-Dichloropropene	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Cyclohexane	0/5	NA	NA	5U - 12U	12.00	100		0.12	No	
Dibromochloromethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Dichlorodifluoromethane	0/5	NA	NA	5U - 12U	12.00	100		0.12	No	
Ethylbenzene	0/5	NA	NA	5U - 12U	12.00	50		0.24	No	
Isopropylbenzene	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
m- and p- Xylenes	0/3	NA	NA	12U	12.00	50		0.24	No	
Methyl acetate	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4

TABLE 7-2
SELECTION OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contaminant Frequency/Range					EPA Region IV ESV	Note	Maximum Hazard Quotient	Soil COPC?	Contaminant Category
	Frequency of Detection	Range of Positive Detections	Location of Maximum Concentration	Range of Detection Limits	Concentration Used For Screening ⁽¹⁾					
Volatile Organic Compounds (ug/kg)(Cont.)										
Methylcyclohexane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Methylene chloride	2/5	12 - 28	SWMU336-TW02-00	12U	28.00	2000		0.01	No	
Methyl-tert-butyl ether (MTBE)	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
o-Xylene	0/3	NA	NA	12U	12.00	50	value for total xylenes	0.24	No	
Styrene	0/5	NA	NA	5U - 12U	12.00	100		0.12	No	
Tetrachloroethene	0/5	NA	NA	5U - 12U	12.00	10		1.20	Yes	2
Toluene	1/5	3J - 3J	SWMU336-TW01-00	5U - 12U	3.00	50		0.06	No	
trans-1,2-Dichloroethene	0/5	NA	NA	5U - 12U	12.00	NA		NA	Yes	4
trans-1,3-Dichloropropene	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Trichloroethene	0/5	NA	NA	5U - 12U	12.00	1		12.00	Yes	2
Trichlorofluoromethane	0/5	NA	NA	5U - 12U	12.00	100	hydrocarbons	0.12	No	
Vinyl chloride	0/5	NA	NA	5U - 12U	12.00	10		1.20	Yes	2
Xylenes (total)	0/3	NA	NA	12U	12.00	50		0.24	No	
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
2,2'-Oxybis(1-chloropropane)	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
2,4,5-Trichlorophenol	0/2	NA	NA	380U - 400U	400.00	4000		0.10	No	
2,4,6-Trichlorophenol	0/2	NA	NA	380U - 400U	400.00	10000		0.04	No	
2,4-Dichlorophenol	0/2	NA	NA	380U - 400U	400.00	3	value for total dichlorophenols	133.33	Yes	2
2,4-Dimethylphenol	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
2,4-Dinitrophenol	0/2	NA	NA	2000UJ - 2100UJ	2100.00	20000		0.11	No	
2,4-Dinitrotoluene	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
2,6-Dinitrotoluene	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
2-Chloronaphthalene	0/2	NA	NA	380U - 400U	400.00	1000	value for chloronapthalene	0.40	No	
2-Chlorophenol	0/2	NA	NA	380U - 400U	400.00	2.5	value for total monochlorophenols	160.00	Yes	2
2-Methylnaphthalene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
2-Methylphenol	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
2-Nitroaniline	0/2	NA	NA	760U - 800U	800.00	100	hydrocarbons	8.00	Yes	2
2-Nitrophenol	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
3,3'-Dichlorobenzidine	0/2	NA	NA	760U - 800U	800.00	100	hydrocarbons	8.00	Yes	2
3-Nitroaniline	0/2	NA	NA	760U - 800U	800.00	100	hydrocarbons	8.00	Yes	2
4,6-Dinitro-2-methylphenol	0/2	NA	NA	760U - 800U	800.00	100	hydrocarbons	8.00	Yes	2
4-Bromophenyl phenyl ether	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
4-Chloro-3-methylphenol	0/2	NA	NA	380U - 400U	400.00	2.5	value for total monochlorophenols	160.00	Yes	2
4-Chloroaniline	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
4-Chlorophenyl phenyl ether	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2
4-Methylphenol	0/2	NA	NA	380U - 400U	400.00	100	hydrocarbons	4.00	Yes	2

TABLE 7-2
SELECTION OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contaminant Frequency/Range					EPA Region IV ESV	Note	Maximum Hazard Quotient	Soil COPC?	Contaminant Category
	Frequency of Detection	Range of Positive Detections	Location of Maximum Concentration	Range of Detection Limits	Concentration Used For Screening ⁽¹⁾					
Semivolatile Organic Compounds (ug/Kg)(Cont.)										
4-Nitroaniline	0/2	NA	NA	760U - 800U	800.00	100	hydrocarbons	8.00	Yes	2
4-Nitrophenol	0/2	NA	NA	760U - 800U	800.00	7000		0.11	No	
Acenaphthene	0/2	NA	NA	380U - 400U	400.00	20000		0.02	No	
Acenaphthylene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Acetophenone	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Anthracene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Atrazine	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Benzaldehyde	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Benzo(a)anthracene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Benzo(a)pyrene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Benzo(b)fluoranthene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Benzo(k)fluoranthene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Benzo(g,h,i)perylene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Bis(2-chloroethoxy)methane	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Bis(2-Chloroethyl)ether	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Bis(2-ethylhexyl)phthalate	2/2	100J - 860	SWMU336-TW01-00	NA	860.00	NA	see value for total phthalates	NA	Yes	3
Butyl benzyl phthalate	1/2	860 - 860	SWMU336-TW01-00	380U	860.00	NA	see value for total phthalates	NA	Yes	3
Caprolactam	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Carbazole	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Chrysene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Dibenz(a,h)anthracene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Dibenzofuran	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Diethyl phthalate	0/2	NA	NA	380U - 400U	400.00	100000		<0.01	No	
Dimethyl phthalate	0/2	NA	NA	380U - 400U	400.00	200000		<0.01	No	
Di-n-butyl phthalate	0/2	NA	NA	380U - 400U	400.00	200000		<0.01	No	
Di-n-octylphthalate	1/2	110J - 110J	SWMU336-TW01-00	380U	110.00	NA		NA	Yes	3
Fluoranthene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Fluorene	0/2	NA	NA	380U - 400U	400.00	30000		0.01	No	
Hexachlorobenzene	0/2	NA	NA	380U - 400U	400.00	2.5		160.00	Yes	2
Hexachlorobutadiene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Hexachlorocyclopentadiene	0/2	NA	NA	380U - 400U	400.00	10000		0.04	No	
Hexachloroethane	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Indeno(1,2,3-cd)pyrene	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Isophorone	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4
Naphthalene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Nitrobenzene	0/2	NA	NA	380U - 400U	400.00	40000		0.01	No	
n-Nitroso-di-n-propylamine	0/2	NA	NA	380U - 400U	400.00	NA		NA	Yes	4

TABLE 7-2
SELECTION OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contaminant Frequency/Range					EPA Region IV ESV	Note	Maximum Hazard Quotient	Soil COPC?	Contaminant Category
	Frequency of Detection	Range of Positive Detections	Location of Maximum Concentration	Range of Detection Limits	Concentration Used For Screening ⁽¹⁾					
Semivolatile Organic Compounds (ug/Kg)(Cont.)										
n-Nitrosodiphenylamine	0/2	NA	NA	380U - 400U	400.00	20000		0.02	No	
Pentachlorophenol	0/2	NA	NA	760U - 800U	800.00	2		400.00	Yes	2
Phenanthrene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Phenol	0/2	NA	NA	380U - 400U	400.00	50		8.00	Yes	2
Pyrene	0/2	NA	NA	380U - 400U	400.00	100		4.00	Yes	2
Total Metals (mg/kg)										
Arsenic	3/5	0.3J - 0.81J	SWMU336-TW05-00	0.63U - 0.64U	0.81	10		0.08	No	
Barium	5/5	10.8J - 48.2	SWMU336-TW02-00	NA	48.20	165		0.29	No	
Cadmium	5/5	0.15J - 4.4	SWMU336-TW02-00	NA	4.40	1.6		2.75	Yes	1
Chromium	2/5	13.8 - 15.3	SWMU336-TW02-00	0.14U	15.30	0.4		38.25	Yes	1
Lead	5/5	6.1 - 18.9J	SWMU336-TW01-00	NA	18.90	50		0.38	No	
Mercury	2/5	0.06 - 0.06	SWMU336-TW01-00, SWMU336-TW02-00	0.11U - 0.12U	0.06	0.1		0.60	No	
Selenium	1/5	0.62 - 0.62	SWMU336-TW02-00	0.55U - 0.71UJ	0.62	0.81		0.77	No	
Silver	0/5	NA	NA	0.1U - 0.24UJ	0.24	2		0.12	No	

Notes:

⁽¹⁾ Maximum concentration. If contaminant was not detected, equals the maximum detection limit.

D = Value is the result of a dilution

U = Chemical was not detected above the method detection limit

J = Estimated Value

NJ = Presumptive evidence for the presence of the material at an estimated value.

COPC = Contaminant of Potential Concern

EPA = Ecological Protection Agency

ESV = Ecological Screening Value

Hazard Quotient = Contaminant Concentration/ ESV

MDL = Maximum detection limit

mg/kg = milligram per kilogram

NA = Not Available

SQL = Sample quantitation limit

ug/kg = microgram per kilogram

TABLE 7-2
SELECTION OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Analyte	Contaminant Frequency/Range					EPA Region IV ESV	Note	Maximum Hazard Quotient	Soil COPC?	Contaminant Category
	Frequency of Detection	Range of Positive Detections	Location of Maximum Concentration	Range of Detection Limits	Concentration Used For Screening ⁽¹⁾					

Notes (Continued):

Contaminant Categories

- 1 Contaminant was found in concentrations exceeding its screening value.
- 2 Contaminant was not found in concentrations exceeding the SQL; however, the MDL exceed its screening value.
- 3 Contaminant was found in concentrations exceeding its SQL; however, there is no current screening value for the contaminant.
- 4 Contaminant was not found in concentrations exceeding the SQL and there is no current screening value for the contaminant.

TABLE 7-3
MEDIA-SPECIFIC SCREENING VALUES FOR STEP 3A
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

Analyte	Step 3A Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference	Comment
Volatile Organics:			
1,1,1-Trichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1,2,2-Tetrachloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	--	
1,1,2-Trichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1-Dichloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,1-Dichloroethene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,2-Dibromoethane	5000	USEPA Region III, 1995	
1,2-Dibromo-3-chloropropane (DBCP)	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
1,2-Dichloroethane	400	MHSPE 1994	
1,2-Dichloropropane	700,000	Efroymsen et. al. 1997	
2-Butanone	89,600	USEPA, 2003	
2-Hexanone	12,600	USEPA, 2003	
4-Methyl-2-Pentanone	10,000	USEPA Region III, 1995	acute value; safety factor of 10 applied
Acetone	2,500	USEPA, 2003	
Benzene	50	MHSPE 1994	
Bromochloromethane	30,000	USEPA Region III, 1995	acute LD50; safety factor of 100 applied
Bromoform	15,900	USEPA, 2003	
Bromomethane	NA	--	
Carbon Disulfide	94.1	USEPA, 2003	
Carbon Tetrachloride	1,000,000	Efroymsen et. al. 1997	
Chlorobenzene	50	Beyer 1990	
Chloroethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Chloroform	1	MHSPE 1994	
Chloromethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
cis-1,2-Dichloroethene	100	Beyer 1990	value for total 1,2-Dichloroethene
cis-1,3-Dichloropropene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Cyclohexane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Dibromomethane	NA	--	
Dichlorodifluoromethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Ethylbenzene	50	Beyer 1990 and MHSPE 1994	
Isopropyl ether	NA	--	
Isopropylbenzene (Cumene)	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
Methyl Acetate	NA	--	
Methyl Cyclohexane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Methylene Chloride	2000	MHSPE 1994	
Styrene	100	Beyer 1990 and MHSPE 1994	
Tetrachloroethene	10	MHSPE 1994	
Toluene	50	Beyer 1990 and MHSPE 1994	
trans-1,2-Dichloroethene	100	Beyer 1990	value for total 1,2-Dichloroethene
trans-1,3-Dichloropropene	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Trichloroethene (TCE)	1	MHSPE 1994	
Trichlorofluoromethane	100	Beyer 1990	value for aliphatic chlorinated hydrocarbons
Vinyl Chloride	10	MHSPE 1994	
Xylene (Total)	50	Beyer 1990 and MHSPE 1994	
Xylene, m/p	50	Beyer 1990 and MHSPE 1994	value for total xylenes
Xylene, o-	50	Beyer 1990 and MHSPE 1994	value for total xylenes
Semivolatile Organics:			
1,1'-Biphenyl	NA	--	
1,2,4-Trichlorobenzene	10	MHSPE 1994	value for trichlorobenzene
1,2-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
1,3-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
1,4-Dichlorobenzene	10	MHSPE 1994	value for dichlorobenzene
2,2'-Oxybis (1-Chloropropane)	NA	--	
2,4,5-Trichlorophenol	4,000	Efroymsen et. al. 1997	

TABLE 7-3
MEDIA-SPECIFIC SCREENING VALUES FOR STEP 3A
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

Analyte	Step 3A Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference	Comment
Semivolatile Organics (Cont.):			
2,4,6-Trichlorophenol	10,000	Efroymson et. al. 1997	
2,4-Dichlorophenol	3	Efroymson et. al. 1997	value for total dichlorophenols
2,4-Dimethylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2,4-Dinitrophenol	20,000	Efroymson et. al. 1997	
2,4-Dinitrotoluene	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2,6-Dinitrotoluene	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Chloronaphthalene	1000	MHSPE 1994	value for chloronaphthalene
2-Chlorophenol	2.5	MHSPE 1994	value for total monochlorophenols
2-Methylnaphthalene	3,240	USEPA, 2003	
2-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
2-Nitrophenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
3,3'-Dichlorobenzidine	100	Beyer 1990	value for total polycyclic chlorinated hydrocarbons
3-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4,6-Dinitro-2-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Bromophenyl-Phenylether	NA	--	
4-Chloro-3-Methylphenol	2.5	MHSPE 1994	value for total monochlorophenols
4-Chloroaniline	1,100	USEPA, 2003	
4-Chlorophenyl-Phenylether	100	Beyer 1990	value for total polycyclic chlorinated hydrocarbons
4-Methylphenol	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Nitroaniline	100	Beyer 1990	value for monocyclic aromatic hydrocarbons
4-Nitrophenol	7,000	Efroymson et. al. 1997	
Acenaphthene	20,000	Efroymson et. al. 1997	
Acenaphthylene	100	USEPA Region III, 1995	
Acetophenone	300,000	USEPA, 2003	
Anthracene	100	Beyer 1990	
Atrazine	NA	--	
Benzaldehyde	NA	--	
Benzo(a)anthracene	100	USEPA Region III, 1995	
Benzo(a)pyrene	100	Beyer 1990	
Benzo(b)fluoranthene	100	USEPA Region III, 1995	
Benzo(g,h,i)perylene	100	USEPA Region III, 1995	
Benzo(k)fluoranthene	100	USEPA Region III, 1995	
bis(2-Chloroethyl)ether	23,700	USEPA, 2003	
bis(2-Chloroethoxy)methane	302	USEPA, 2003	
bis(2-Ethylhexyl)phthalate	100	MHSPE 1994	lowest value for total phthalates
Butylbenzylphthalate	100	MHSPE 1994	lowest value for total phthalates
Caprolactam	NA	--	
Carbazole	NA	--	
Chrysene	100	USEPA Region III, 1995	
Dibenzo(a,h)anthracene	100	USEPA Region III, 1995	
Dibenzofuran	NA	--	
Diethylphthalate	100,000	Efroymson et. al. 1997	
Dimethylphthalate	200,000	Efroymson et. al. 1997	
Di-n-butylphthalate	200,000	Efroymson et. al. 1997	
Di-n-octylphthalate	100	MHSPE 1994	lowest value for total phthalates
Fluoranthene	100	Beyer 1990	
Fluorene	30,000	Efroymson et. al. 1997	
Hexachlorobenzene	2.5	MHSPE 1994	
Hexachlorobutadiene	39.8	USEPA, 2003	
Hexachlorocyclopentadiene	10,000	Efroymson et. al. 1997	
Hexachloroethane	596	USEPA, 2003	
Indeno(1,2,3-cd)pyrene	100	USEPA Region III, 1995	
Isophorone	139,000	USEPA, 2003	

TABLE 7-3
MEDIA-SPECIFIC SCREENING VALUES FOR STEP 3A
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUENE, NORTH CAROLINA

Analyte	Step 3A Soil Screening Values		
	(ug/kg) or (mg/kg) ⁽¹⁾	Reference	Comment
Semivolatile Organics (Cont.):			
Naphthalene	100	Beyer 1990	
Nitrobenzene	40,000	Efroymsen et. al. 1997	
n-Nitroso-di-n-propylamine	544	USEPA, 2003	
n-Nitrosodiphenylamine	20,000	Efroymsen et. al. 1997	
Pentachlorophenol	2	MHSPE 1994	
Phenanthrene	100	Beyer 1990	
Phenol	50	MHSPE 1994	
Pyrene	100	Beyer 1990	
PAHs (total)	1000	Beyer 1990, MHSPE 1994	
Phthalates (total)	100	MHSPE 1994	
Total Inorganics:			
Arsenic	10	Efroymsen et. al. 1997	18 Eco-SSL terrestrial plants (USEPA 2003)
Barium	165	Crommentuijn et. al. 1997	330 Eco-SSL soil invertebrates (USEPA 2003)
Cadmium	1.6	Crommentuijn et. al. 1997	0.36 Eco-SSL mammalian wildlife (USEPA 2003)
Chromium (Total)	0.4	Efroymsen et. al. 1997 and CCME 1997	26 Eco-SSL avian wildlife (USEPA 2003)
Lead	50	Beyer 1990 and Efroymsen et. al. 1997	16 Eco-SSL avian wildlife (USEPA 2003)
Mercury	0.1	Efroymsen et. al. 1997	
Selenium	0.81	Crommentuijn et. al. 1997	
Silver	2	Efroymsen et. al. 1997	

Notes:

NA = Not Applicable/ Not Established

CCME = Canadian Council of Ministers of the Environment

MHSPE = Ministry of Housing, Spatial Planning, and the Environment

USEPA = United States Environmental Protection Agency

⁽¹⁾ Soil screening values are in microgram per kilogram (ug/kg) for organic compounds and in milligram per kilogram (mg/kg) for inorganic constituents.

⁽²⁾ Non-shaded values are USEPA Region IV screening values obtained from *Guidelines for Performing Screening Level Ecological Risk Assessments within the North Carolina Division of Waste Management* (NCDENR 2003); Reference cited shows original reference.

Shading indicates a screening value not included in NCDENR 2003.

TABLE 7-4
REFINED ASSESSMENT OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Ecological Chemicals of Potential Concern based on Steps 1 and 2	Contaminant Category ⁽¹⁾	Refined Risk Screening			Background Comparison			Frequency of Detection		Important Bioaccumulative Chemical? ⁽⁵⁾	Further Evaluation Recommended based on Step 3A?	Comments
		Arithmetic Mean (Half Non-Detects)	Refined Surface Soil Screening Value (SSSV) ⁽²⁾	Mean HQ ⁽³⁾	Maximum Site Concentration	2 X Mean Background ⁽⁴⁾	Maximum Site Concentration Less than 2X Background?	Frequency of Detection	Contaminant Detected?			
Volatile Organic Compounds (ug/kg)												
1,1,2-Trichloro-1,2,2-trifluoroethane	4	4.70	NA	NA	ND	NA	NA	0/5	No	No	No	Not Detected
1,2,4-Trichlorobenzene	2	4.70	10	0.47	ND	NA	NA	0/5	No	Yes	No	Mean HQ < 1.0 Not Detected
1,2-Dibromoethane	4	4.70	5000	<0.01	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
1,2-Dichlorobenzene	2	4.70	10	0.47	ND	NA	NA	0/5	No	Yes	No	Mean HQ < 1.0 Not Detected
1,3-Dichlorobenzene	2	4.70	10	0.47	ND	NA	NA	0/5	No	Yes	No	Mean HQ < 1.0 Not Detected
1,4-Dichlorobenzene	2	4.70	10	0.47	ND	NA	NA	0/5	No	Yes	No	Mean HQ < 1.0 Not Detected
2-Butanone	4	6.20	89600	<0.01	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
2-Hexanone	4	6.20	12600	<0.01	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
4-Methyl-2-pentanone	4	6.20	10000	<0.01	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Acetone	3	11.80	2500	<0.01	33	NA	NA	2/5	Yes	No	No	Mean HQ < 1.0 Not Detected
Bromoform	4	4.70	15900	<0.01	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Bromomethane	4	4.70	NA	NA	ND	NA	NA	0/5	No	No	No	Not Detected
Carbon disulfide	4	4.70	94.1	0.05	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Chloroform	2	4.70	1	4.70	ND	NA	NA	0/5	No	No	No	Not Detected
cis-1,2-Dichloroethene	4	4.70	100	0.05	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Methyl acetate	4	4.70	NA	NA	ND	NA	NA	0/5	No	No	No	Not Detected
Methyl-tert-butyl ether (MTBE)	4	4.70	NA	NA	ND	NA	NA	0/5	No	No	No	Not Detected
Tetrachloroethene	2	4.70	10	0.47	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
trans-1,2-Dichloroethene	4	4.70	100	0.05	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
trans-1,3-Dichloropropene		4.70	100	0.05	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Trichloroethene	2	4.70	1	4.70	ND	NA	NA	0/5	No	No	No	Not Detected
Vinyl chloride	2	4.70	10	0.47	ND	NA	NA	0/5	No	No	No	Mean HQ < 1.0 Not Detected
Semivolatile Organic Compounds (ug/kg)												
1,1'-Biphenyl	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
2,2'-Oxybis(1-chloropropane)	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
2,4-Dichlorophenol	2	195.00	3	65.00	ND	NA	NA	0/2	No	No	No	Not Detected
2,4-Dimethylphenol	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
2,4-Dinitrotoluene	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
2,6-Dinitrotoluene	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected

TABLE 7-4
REFINED ASSESSMENT OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Ecological Chemicals of Potential Concern based on Steps 1 and 2	Contaminant Category ⁽¹⁾	Refined Risk Screening			Background Comparison			Frequency of Detection		Important Bioaccumulative Chemical? ⁽⁵⁾	Further Evaluation Recommended based on Step 3A?	Comments
		Arithmetic Mean (Half Non-Detects)	Refined Surface Soil Screening Value (SSSV) ⁽²⁾	Mean HQ ⁽³⁾	Maximum Site Concentration	2 X Mean Background ⁽⁴⁾	Maximum Site Concentration Less than 2X Background?	Frequency of Detection	Contaminant Detected?			
Semivolatile Organic Compounds (ug/kg)(Cont.)												
2-Chlorophenol	2	195.00	2.5	78.00	ND	NA	NA	0/2	No	No	No	Not Detected
2-Methylnaphthalene	4	195.00	3240	0.06	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
2-Methylphenol	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
2-Nitroaniline	2	390.00	100	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
2-Nitrophenol	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
3,3'-Dichlorobenzidine	2	390.00	100	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
3-Nitroaniline	2	390.00	100	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
4,6-Dinitro-2-methylphenol	2	390.00	100	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
4-Bromophenyl phenyl ether	4	195.00	NA	NA	ND	NA	NA	0/2	No	Yes	No	Not Detected
4-Chloro-3-methylphenol	2	195.00	2.5	78.00	ND	NA	NA	0/2	No	No	No	Not Detected
4-Chloroaniline	4	195.00	1100	0.18	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
4-Chlorophenyl phenyl ether	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
4-Methylphenol	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
4-Nitroaniline	2	390.00	100	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
Acenaphthylene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Acetophenone	4	195.00	300000	<0.01	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
Anthracene	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Atrazine	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
Benzaldehyde	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
Benzo(a)anthracene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Benzo(a)pyrene	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Benzo(b)fluoranthene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Benzo(k)fluoranthene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Benzo(g,h,i)perylene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Bis(2-chloroethoxy)methane	4	195.00	302	0.65	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
Bis(2-Chloroethyl)ether	4	195.00	23700	<0.01	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
Bis(2-ethylhexyl)phthalate	3	480.00	100	4.80	860	NA	NA	2/2	Yes	No	No	Mean HQ > 1.0, see text
Butyl benzyl phthalate	3	525.00	100	5.25	860	NA	NA	1/2	Yes	No	No	Mean HQ > 1.0, see text
Caprolactam	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
Carbazole	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
Chrysene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Dibenz(a,h)anthracene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Dibenzofuran	4	195.00	NA	NA	ND	NA	NA	0/2	No	No	No	Not Detected
Di-n-octylphthalate	3	150.00	100	1.10	110 J	NA	NA	1/2	Yes	No	No	Mean HQ > 1.0, see text
Fluoranthene	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected

TABLE 7-4
REFINED ASSESSMENT OF ECOLOGICAL COPCs IN SURFACE SOIL
SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Ecological Chemicals of Potential Concern based on Steps 1 and 2	Contaminant Category ⁽¹⁾	Refined Risk Screening			Background Comparison			Frequency of Detection		Important Bioaccumulative Chemical? ⁽⁵⁾	Further Evaluation Recommended based on Step 3A?	Comments
		Arithmetic Mean (Half Non-Detects)	Refined Surface Soil Screening Value (SSSV) ⁽²⁾	Mean HQ ⁽³⁾	Maximum Site Concentration	2 X Mean Background ⁽⁴⁾	Maximum Site Concentration Less than 2X Background?	Frequency of Detection	Contaminant Detected?			
Semivolatile Organic Compounds (ug/kg)(Cont.)												
Hexachlorobenzene	2	195.00	2.5	78.00	ND	NA	NA	0/2	No	Yes	No	Not Detected
Hexachlorobutadiene	4	195.00	39.8	4.90	ND	NA	NA	0/2	No	Yes	No	Not Detected
Hexachloroethane	4	195.00	596	0.33	ND	NA	NA	0/2	No	Yes	No	Mean HQ < 1.0 Not Detected
Indeno(1,2,3-cd)pyrene	4	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Isophorone	4	195.00	139000	<0.01	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
Naphthalene	2	195.00	100	1.95	ND	NA	NA	0/2	No	No	No	Not Detected
n-Nitroso-di-n-propylamine	4	195.00	544	0.36	ND	NA	NA	0/2	No	No	No	Mean HQ < 1.0 Not Detected
Pentachlorophenol	2	390.00	2	195.00	ND	NA	NA	0/2	No	Yes	No	Not Detected
Phenanthrene	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Phenol	2	195.00	50	3.90	ND	NA	NA	0/2	No	No	No	Not Detected
Pyrene	2	195.00	100	1.95	ND	NA	NA	0/2	No	Yes	No	Not Detected
Total Metals (mg/kg)												
Cadmium	1	1.42	1.6	0.89	4	0.03	No	5/5	Yes	Yes	No	Mean HQ < 1.0
Chromium	1	5.86	0.4	14.66	15	12.68	No	2/5	Yes	Yes	No	Mean HQ > 1.0, see text

Notes:

U = Chemical was not detected above the method detection limit

J = Estimated Value

HQ = Hazard Quotient

Hazard Quotient = Contaminant Concentration/ ESV

mg/kg = milligram per kilogram

ug/kg = microgram per kilogram

NA = Not Applicable

⁽¹⁾ See Table 7-2 and text for definitions of contaminant categories

⁽²⁾ References for all screening values are provided on Table 7-3

⁽³⁾ The mean HQ represents the mean (half non-detect) concentration divided by the screening value. In cases where the mean exceeds the maximum the maximum value is use

⁽⁴⁾ The background concentration presented is for AOC 2 surface soils (Final Area of Concern Background Study [Baker 2001])

⁽⁵⁾ Compound is identified as an "important bioaccumulative chemical" in the USEPA document *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs* (EPA-823-R-00-001, February 2000).



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FIGURES



R:\CH2M HILL\CLERMONT\CTO 091 (104559)\CAD\RI 336\CH291-336-00 CONTOURS



NOTE:
NO SAMPLING PERFORMED IN
PHASE I EVENT

"1 MILE TO SOUTHWEST CREEK"

AS4106

AS4107

6431.25 ft TO THE NEW RIVER

6431.25 ft TO THE NEW RIVER

AS4105

SWMU336-GW10/PZ10

WASH SINK
PAINT STRIPPING
KIT
FLOOR DRAIN
FLOOR DRAIN
AS4106

SWMU336-GW08/PZ08

SWMU336-GW09

SWMU336-GW01/PZ01

SWMU336-TW03

SWMU336-TW04

SWMU336-TW05

SWMU336-TW06

FIGURE 7-1
AERIAL VIEW OF SITE
RCRA FACILITY INVESTIGATION
SWMU 336
MARINE CORPS BASE, CAMP LEJUNE
NORTH CAROLINA

LEGEND

- PHASE II TEMPORARY WELL LOCATION
- ADDITIONAL PHASE II TEMPORARY WELL LOCATION
- RFI GROUNDWATER GRAB/PIEZOMETER LOCATION
- RFI SOIL BORING/GROUNDWATER GRAB LOCATION

SOURCE: MCB CAMP LEJUNE, MARCH 2000

1 inch = 50 ft

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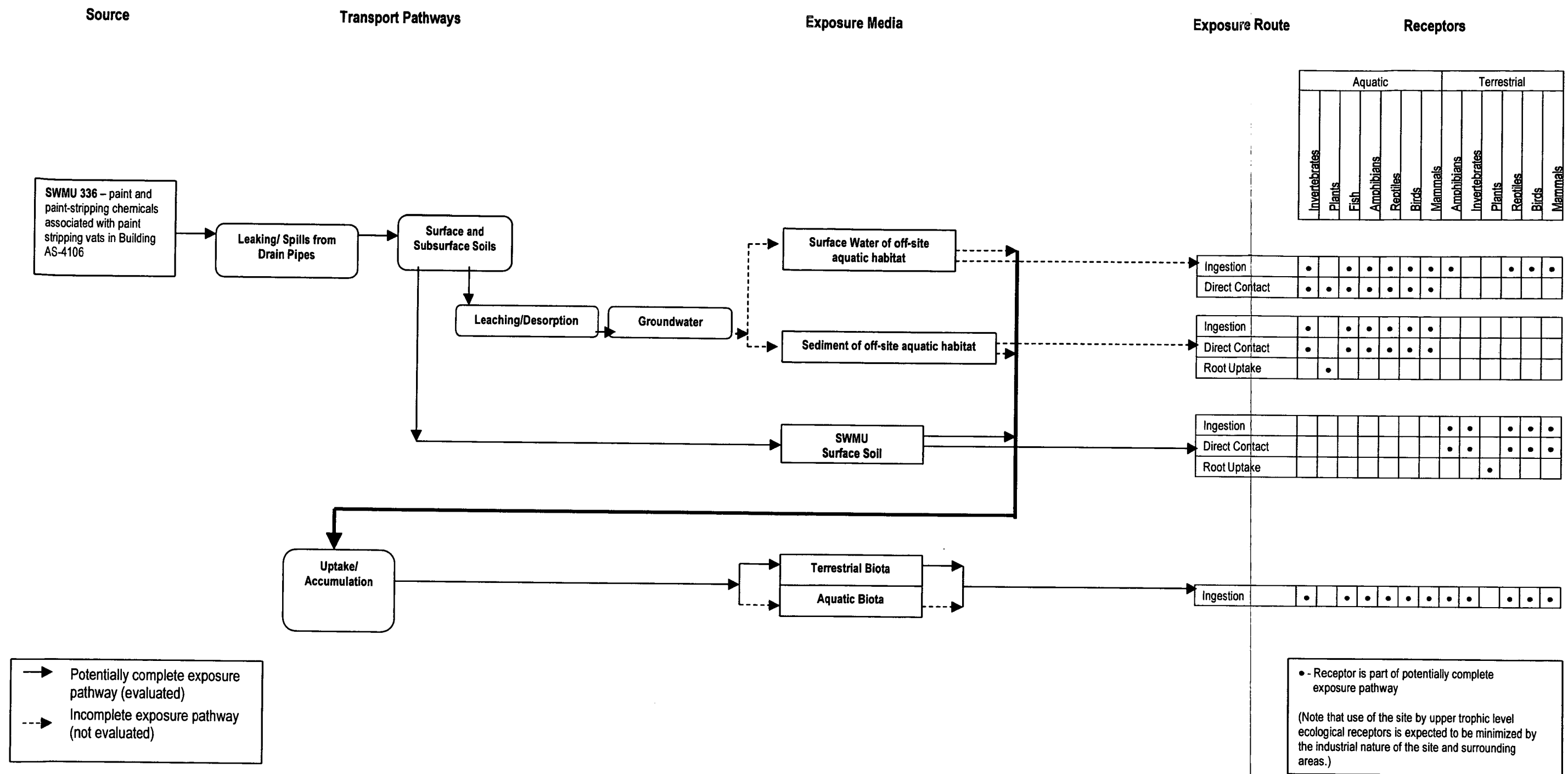


FIGURE 7-2. ECOLOGICAL CONCEPTUAL MODEL
SWMU 336, MCB CAMP LEJEUNE

8.0 CONCLUSIONS AND RECOMMENDATIONS

This section provides a discussion of conclusions that were rendered based on the data collected from the Phase II CSI and the RFI. Recommendations for future actions are also discussed.

Cadmium and methylene chloride were detected in soil at concentrations exceeding the regulatory-driven screening values. The cadmium contamination appears to be limited to one surface soil sample near the SWMU and the methylene chloride contamination was limited to this same surface soil sample and one subsurface soil sample.

PCE was detected in groundwater at concentrations exceeding the regulatory-driven screening values. The PCE contamination was detected at three temporary well locations. This contamination has been bounded and is limited to a small localized area at the SWMU.

Current land use scenarios were evaluated in the baseline HHRA for SWMU 336. There were no unacceptable carcinogenic risks or adverse noncarcinogenic hazard levels calculated that exceeded USEPA's acceptable criteria for the current military Base personnel, future adolescent trespasser, or future construction worker.

There were no adverse noncarcinogenic health hazards calculated that exceeded USEPA's acceptable criteria for the future adult and child residents. The total ILCRs exceeded the USEPA acceptable range of 1×10^{-6} to 1×10^{-4} for the future adult and child residents when considering the RME, or reasonable maximum exposure, scenario. This is caused by ingestion of and dermal contact with PCE in the shallow groundwater. However, it should be noted that the total ILCRs for the adult and child were within USEPA's acceptable range under the CT, or average, exposure scenario.

It should also be noted that the maximum detected concentration of PCE in the groundwater data set came from sample SWMU336-GW01, which was collected from a temporary well during the Phase II CSI investigation. It should be noted that PCE was not detected in any of the groundwater samples collected during the RFI. Furthermore, the maximum detected concentrations were used in the risk calculations because there was no definitive plume found at this SWMU. The use of maximum concentrations from SWMU336-GW01 likely overestimates the actual risks to these receptors from the SWMU. It is also unlikely that the shallow groundwater at the SWMU would be used as potable water source.

Therefore, based on the quantitative results of the baseline HHRA, unacceptable risk was calculated for future residents upon exposure to groundwater investigated at the SWMU. However, consideration should be given to the conservatism added to the groundwater exposure evaluation.

Based on the results of the Screening Level Ecological Risk Assessment (SLERA) and Step 3A of the Baseline Ecological Risk Assessment (BERA) at SWMU 336, none of the 75 chemicals identified as ecological COPCs are recommended for further evaluation. Surface soils at the SWMU are not indicated to pose unacceptable risks to ecological receptors and no further evaluation is recommended.

No aquatic habitat was present at SWMU 336. The groundwater exposure pathway was evaluated to determine if there was the potential for off-site risk to aquatic receptors via the discharge of contaminated groundwater from the site. This pathway was determined to be incomplete; therefore, no unacceptable ecological risk to aquatic habitat is posed by the SWMU.

Future actions with respect to groundwater are recommended because PCE detected in samples from the temporary monitoring wells were above the North Carolina 2L Standards. These actions may include installing monitoring wells in locations where sample numbers SWMU336-GW01, SWMU336-TW03 and SWMU336-TW06 were collected and resampling the groundwater in the vicinity of these samples. If the PCE detections are duplicated, then additional monitoring wells could be installed in a manner that would promote long-term monitoring at this site. If the PCE detections are not duplicated, then a third sample could be collected from the monitoring wells and no further action should be implemented at the site if the most recent results indicate that the PCE detections can not be duplicated.

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APPENDIX A

Test Boring and Piezometer Construction Records

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TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: SWMU Investigation

PROJ. NO.: CTO-0143

BORING NO.:

SWMU336- TW01

COORDINATES: EAST:

NORTH:

ELEVATION: SURFACE:

TOP OF PVC CASING:

Rig: A-200 Ingersol Ram					Date	Progress (Ft.)	Comment	Depth to Water (Ft.)
Size (ID)	Macro Core	Casing	Augers	Acetate sleeve				
Length	2"		3.25	2"	3/20/2002	16	estimated	8
Type	4		5'	4'				
Hammer Wt.	SS		S	Acetate				
Fall	NA		NA	NA				
	NA		NA	NA				

SAMPLE TYPE						WELL INFORMATION			
M = Macro Core A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						PVC Riser (Schedule 40)	1"		
						PVC screen (Schedule 40) 0.010"	1"		

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft., %)	Lab ID	LEL %	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1			SWMU336-TW01-00			Fine sand, trace silt, loam, moist, brown	cuttings	
2	M-1	3.4 85%		0.0%	0.0	Fine sand, trace silt, moist, brown	riser	
3						Fine sand, and clay, moist, brown	bentonite	
4							riser	
5						Fine sand, trace silt, wet, gray	sand	
6	M-2	2.7 68%		0.0%	0.0	Clay, moist, plastic, brownish gray	screen	
7						Clay, little sand, moist, plastic, brownish gray		
8							sand	
9			SWMU336-TW01-04			Fine sand, little clay, wet, light gray, trace orange motteling	screen	
10	M-3	4.0 100%		0.0%	0.0		sand	

DRILLING CO.: Parratt Wolff Inc.

DRILLER: Mark Eaves / Jim Robertson

BAKER REP.: David D. Schilling

BORING NO.: SWMU336- TW01

SHEET 1 OF 2

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TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: SWMU InvestigationCTO NO.: CTO-0143BORING NO.: SWMU336- TW01

SAMPLE TYPE						DEFINITIONS		
M = Macro Core A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Lab ID	LEL %	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Continued from Sheet 1		
12								
13						Fine sand, little clay, wet, light gray, trace orange motteling		
14	M-4	4.0 100%		0.0%	0.0 0.0			
15								
16								
17						End of Boring = 16.0		
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt Wolff Inc.
DRILLER: Mark Eaves / Jim Robertson

BAKER REP.: David D. Schilling
BORING NO.: SWMU336- TW01 SHEET 2 OF 2

Baker

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TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: SWMU InvestigationPROJ. NO.: CTO-0143BORING NO.: SWMU336- TW02

COORDINATES: EAST: _____

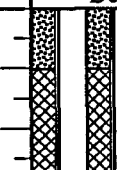
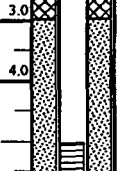
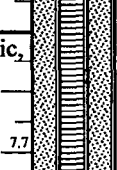
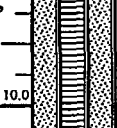
NORTH: _____

ELEVATION: SURFACE: _____

TOP OF PVC CASING: _____

Rig:	A-200 Ingersol Ram				Date	Progress (Ft.)	Comment	Depth to Water (Ft.)
	Macro Core	Casing	Augers	Acetate sleeve				
Size (ID)	2"		3.25	2"	3/20/2002	15	estimated	7.7
Length	4		5'	4'				
Type	SS		S	Acetate				
Hammer Wt.	NA		NA	NA				
Fall	NA		NA	NA				

Remarks:

SAMPLE TYPE						WELL INFORMATION			
M = Macro Core A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						PVC Riser (Schedule 40)	1"		
						PVC screen (Schedule 40) 0.010"	1"		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Lab ID	LEL %	PID (ppm) ps/bg	Visual Description	Well Installation Detail		Elevation (Ft. MSL)
1	M-1	4.0 100%	SWMU336-TW02-00	0.0%	0.0 0.0	Fine sand, some clay, moist, semi-plastic, dark brown			
2									
3									
4	A-N					Clay, trace fine sand, moist, plastic, orange motteling			
5									
6									
7	M-2	3.7 93%	SWMU336-TW02-04	0.0%	0.0 0.0	Clay and fine sand, moist, plastic, light gray			
8									
9									
10	A-N								

 DRILLING CO.: Parratt Wolff Inc.
 DRILLER: Mark Eaves / Jim Robertson

 BAKER REP.: David D. Schilling
 BORING NO.: SWMU336- TW02 SHEET 1 OF 2



TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: SWMU Investigation

CTO NO.: CTO-0143

BORING NO.: SWMU336- TW02

SAMPLE TYPE						DEFINITIONS		
M = Macro Core A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	Lab ID	LEL %	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Continued from Sheet 1		
12								
13								
14								
15								
16						End of Boring = 15.0		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt Wolff Inc.
 DRILLER: Mark Eaves / Jim Robertson

BAKER REP.: David D. Schilling
 BORING NO.: SWMU336- TW02 SHEET 2 OF 2

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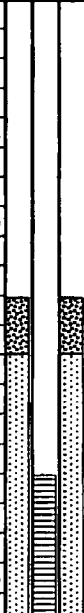
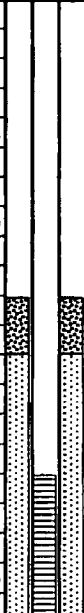
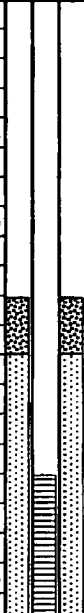
TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: Camp Lejeune RCRA Program - SWMU 336PROJ. NO.: CTO-0143BORING NO.: TW03COORDINATES: EAST: 2465244.01NORTH: 353706.790

ELEVATION: SURFACE: _____

TOP OF PVC CASING: 26.59

Rig: <u>Ingersol-Rand</u>					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	Macro Spoon	Casing	Augers	Core Barrel				
Size (ID)	2-in	--	3-3/4-in	--	6/23/2003	0.0 - 18.0	NA	10.0
Length	4-ft	--	5-ft	--				
Type	Acetate	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Sample ID is as follows: "SWMU336-TW03-__", with the suffix shown below.

SAMPLE TYPE						WELL INFORMATION			
S = Sample A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						Sch 40 PVC Casing	1-in	0.0	8.0
						Sch 40 10-Slot PVC Screen	1-in	8.0	18.0
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail		Elevation (Ft. MSL)
1	S-1	3.3 83%	--	00	0	F.SAND, little silt, dark gray, loose damp			
2					0	F.SAND, trace silt, brown, loose, damp			
3					0	CLAY, trace sand, orange & gray mottled, firm, semi-plastic, damp			
4					0				
4.0						4.0			
5	S-2	3.9 98%	--	--	0.1	M.SAND, trace silt, orangish brown, loose, moist			5.0
6					0	CLAY, little sand, orange and gray mottled, firm, semi-plastic, damp			
7					0				
8					0				
8.0						8.0			8.0
9	S-3	3.7 93%	--	04 04D	0.6				
10					0				
					0.1				
					0	CLAY, little sand, orange and			
					0				

DRILLING CO.: Parratt-WolffDRILLER: Lewis LeFeverBAKER REP.: David D. SchillingBORING NO.: TW03 SHEET 1 OF 2



TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Lejeune RCRA Program - SWMU 336

CTO NO.: CTO-0143

BORING NO.: TW03

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					0	gray mottled, firm, semi-plastic,		
12					0.1	wet		11.5
13					0	F.SAND & CLAY, gray, plastic, loose, wet		
14								
15	A-N	--	--	--	--			
16								
17								
18	18.0						18.0	18.0
19						Termination Depth at 18.0-ft		
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff
 DRILLER: Lewis LeFever

BAKER REP.: David D. Schilling
 BORING NO.: TW03 SHEET 2 OF 2

Baker

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TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: Camp Lejeune RCRA Program - SWMU 336PROJ. NO.: CTO-0143BORING NO.: TW04COORDINATES: EAST: 2465218.470NORTH: 353707.33

ELEVATION: SURFACE: _____

TOP OF PVC CASING: 23.42

Rig: <u>Ingersol-Rand</u>					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	Macro Spoon	Casing	Augers	Core Barrel				
Size (ID)	2-in	--	3-3/4-in	--	6/23/2003	0.0 - 16.0	NA	11.6
Length	4-ft	--	5-ft	--				
Type	Acetate	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Sample ID is as follows: "SWMU336-TW04-__", with the suffix shown below.

SAMPLE TYPE						WELL INFORMATION			
S = Sample A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						Sch 40 PVC Casing	1-in	0.0	6.0
						Sch 40 10-Slot PVC Screen	1-in	6.0	16.0
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail		Elevation (Ft. MSL)
1	S-1	4.0 100%	--	00	0	ASPHALT	0.2		
					0	SAND & GRAVEL	0.8		
2					2.3	CLAY, trace sand, orange and gray mottled, firm, semi-plastic, damp			
					0				
3	S-2	3.8 95%	--	--	0.1				
					0				
4					0				
					0				
5	S-3	3.8 95%	--		0				
					0				
6					0				
					0				
7	S-4				0	CLAY, little sand, olive drab, orange staining, firm, plastic, moist			
					0				
8					0				
					0				
9	S-5				0				
					0				
10					0				
					0	CLAY, trace sand, olive drab,			

DRILLING CO.: Parratt-WolffDRILLER: Lewis LeFeverBAKER REP.: David D. SchillingBORING NO.: TW04SHEET 1 OF 2



TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Lejeune RCRA Program - SWMU 336

CTO NO.: CTO-0143

BORING NO.: TW04

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					0	soft, plastic, moist		
12				06	0	M.SAND, trace silt, brownish gray		
13						loose, wet		
14	A-N	--	--	--	--			
15								
16						Termination Depth at 16.0-ft		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff

DRILLER: Lewis LeFever

BAKER REP.: David D. Schilling

BORING NO.: TW04 SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: Camp Lejeune RCRA Program - SWMU 336PROJ. NO.: CTO-0143BORING NO.: TW05COORDINATES: EAST: 2465218.160NORTH: 353682.95

ELEVATION: SURFACE: _____

TOP OF PVC CASING: 26.42

Rig: <u>Ingersol-Rand</u>					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	Macro Spoon	Casing	Augers	Core Barrel				
Size (ID)	2-in	--	3-3/4-in	--	6/23/2003	0.0 - 17.0	NA	8.0
Length	4-ft	--	5-ft	--				
Type	Acetate	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Sample ID is as follows: "SWMU336-TW05-__", with the suffix shown below.

SAMPLE TYPE						WELL INFORMATION			
S = Sample A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						Sch 40 PVC Casing	1-in	0.0	7.0
						Sch 40 10-Slot PVC Screen	1-in	7.0	17.0
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft., %)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail		Elevation (Ft. MSL)
1	S-1	2.6 65%	--	00	0.2	SAND & GRAVEL, sub-base			
					0	CLAY, trace sand, gray, firm, non-plastic, damp			
2					0.1				
					0				
3	S-2	2.3 58%	--	04	0	SAND & GRAVEL			
					0	CLAY, trace sand, orangish br., firm, semi-plastic, damp			
4					0.4				
					0				
5	S-3	0.4 10%	--	--	0.2	SAND & GRAVEL			
					0	CLAY, tr. sand, orangish br., firm, semi-plastic, damp			
6					0	CLAY & GRAVEL, black, soft, semi-plastic, moist			
					0	CLAY, little f.sand, gray, soft, plastic, moist			
7	S-4		--		0.2	CLAY, trace sand, trace gravel			
					0	brownish gray, soft, plastic, wet			
8					0				
					0				
9	S-5		--		0.2				
					0				
10					0				
					0				

DRILLING CO.: Parratt-WolffDRILLER: Lewis LeFeverBAKER REP.: David D. SchillingBORING NO.: TW05 SHEET 1 OF 2



TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Lejeune RCRA Program - SWMU 336

CTO NO.: CTO-0143

BORING NO.: TW05

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11								
12								
13								
14								
15	A-N	--	--	--	--			
16								
17								
18						Termination Depth at 17.0-ft		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff
 DRILLER: Lewis LeFever

BAKER REP.: David D. Schilling

BORING NO.: TW05 SHEET 2 OF 2

Baker

Baker Environmental

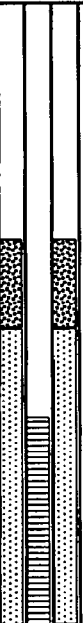
TEST BORING AND WELL CONSTRUCTION RECORDPROJECT: Camp Lejeune RCRA Program - SWMU 336PROJ. NO.: CTO-0143BORING NO.: TW06COORDINATES: EAST: 2465233.190NORTH: 353693.58

ELEVATION: SURFACE: _____

TOP OF PVC CASING: 27.09

Rig: <u>Ingersol-Rand</u>					Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
	Macro Spoon	Casing	Augers	Core Barrel				
Size (ID)	2-in	--	3-3/4-in	--	6/23/2003	0.0 - 17.0	NA	14.2
Length	4-ft	--	5-ft	--				
Type	Acetate	--	HSA	--				
Hammer Wt.	--	--	--	--				
Fall	--	--	--	--				

Remarks: Sample ID is as follows: "SWMU336-TW06-__", with the suffix shown below.

SAMPLE TYPE						WELL INFORMATION			
S = Sample A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Direct Push P = Piston N = No Sample						Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
						Sch 40 PVC Casing	1-in	0.0	7.0
						Sch 40 10-Slot PVC Screen	1-in	7.0	17.0
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft., %)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail		Elevation (Ft. MSL)
1	S-1	1.8 45%	--	00	0.1	CLAY, trace sand, grayish brown,			
					0	firm, non-plastic, damp			
2					0	CLAY, trace sand, orangish			
					0	brown, firm, plastic, moist			
3	S-2	1.6 40%	--	--	0				
4					0	CLAY & SAND, orangish brown,			
					0	firm, plastic, moist, terracotta pipe			
5					0	fragments			
6	S-3	3.8 95%	--	--	0				
7					0	CLAY & SAND, brown, plastic,			
8					0	saturated			
9					0				
10					0	CLAY, little sand, orange and gray			
					0	mottled, firm, plastic, moist			

DRILLING CO.: Parratt-WolffDRILLER: Lewis LeFeverBAKER REP.: David D. SchillingBORING NO.: TW06 SHEET 1 OF 2



TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Camp Lejeune RCRA Program - SWMU 336

CTO NO.: CTO-0143

BORING NO.: TW06

SAMPLE TYPE						DEFINITIONS		
S = Split Spoon A = Auger T = Shelby Tube W = Wash R = Air Rotary C = Core D = Denison P = Piston N = No Sample						SPT = Standard Penetration Test (ASTM D1586) PID = Photo Ionization Detector Measurement MSL = Mean Sea Level ps/bg = point source/background		
Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11					0			
12					0			
13					0			
14	S-4	3.7 93%	--	07	0	CLAY & SAND, orangish brown, firm, plastic, moist		
15					0			
16					0	F.SAND, little clay, gray, very loose, wet		
17	A-N	--	--	--	--			17.0
18						Termination Depth at 17.0-ft		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parratt-Wolff
 DRILLER: Lewis LeFever

BAKER REP.: David D. Schilling
 BORING NO.: TW06 SHEET 2 OF 2

BKR_E_PID (LD4)
(02/05 Baker)

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION _____ OFFSET _____ BASELINE _____

COORDINATES: NORTH: 353736.1493 EAST: 2465146.85

INSPECTOR (SIGNED) J. Rodzankas DRILLERS NAME/COMPANY

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: 9.5 TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES): _____

BORING NO. 336-SB01

SHEET 1 OF 2

DATE: START 2/1/2005

END 2/1/2005

O.G. ELEV. 21.943767

Chip LeFever/ Parratt Wolff

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	RQD (FT.)	RECOVERY (%)	RQD (%)	PID (ppm) or FID (ppm)	USCS	AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0			4	100							ASPHALT	EL. 21.6
1						0.0		CL			SAND and GRAVEL; light brown; dry; (subbase)	Collected SWMU 336-SB01 (0'-1')
2	DP-1					0.0					CLAY, little silt, trace sand; dark gray w/ orange mottling; moist	EL. 21.1
3						0.0						
4						0.0		ML				
4.0			3	75							SILT, little sand, trace clay; lt. gray w/ orange mottling; moist	EL. 17.9
5						<1.0						Collected SWMU 336 SB01-02 (3'-5')
6	DP-2					<1.0						
7						<1.0		SM			F. SAND, little to some silt, trace clay; light gray; moist	EL. 15.2
8			2.3	57								
8.0						<1.0						
9												
10	DP-3					2.6		SW-SM			F. SAND, little medium sand, trace to little silt; gray; wet	Collected SWMU 336 SB01-04 (8'-9.5')
11						2.6						EL. 12.4
12												
12.0												
13												
14	F-1										Slightly turbid	EL. 7.9
15												Purged approx. 0.5 gal.
16			4	100								Collected SWMU 336-GW01 (12'-16')
16.0						1.8						
17						<1.0						
18	DP-4					<1.0						
19						1.3						

BKR_E_PID (LD4)
(02/05 Baker)

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION _____ OFFSET _____ BASELINE _____

COORDINATES: NORTH: 353736.1493 EAST: 2465146.85

INSPECTOR (SIGNED) J. Rodzankas

DRILLERS NAME/COMPANY

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: 9.5 TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES): _____

BORING NO. 336-SB01

SHEET 2 OF 2

DATE: START 2/1/2005

END 2/1/2005

O.G. ELEV. 21.943767

Chip LeFever/ Parrott Wolff

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	RQD (FT.)	RECOVERY (%)	RQD (%)	PID (ppm) or FID (ppm)	USCS	AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
20												
21							2.0					
22	DP-5						1.4	SP				
23							1.2					
24	F-2		4	100			1.7					
25							0.0					
26	DP-6						0.0	ML				
27							0.0					
28							0.0	GM				
29			4	100			0.0					
30	DP-7						0.0					
31							0.0					
32							<1.0					
33												
34												
35												
36												
37												
38												
39												

Bottom of Boring

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Bottom of Boring

BKR E PID (LD4)
(02/05 Baker)

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION _____ OFFSET _____ BASELINE _____

COORDINATES: NORTH: 353664.4703 EAST: 2465184.484

INSPECTOR (SIGNED) Dan Tomczak

DRILLERS NAME/COMPANY _____

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: _____ TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES): _____

BORING NO. 336-GW04

SHEET 1 OF 2

DATE: START 2/1/2005

END 2/1/2005

O.G. ELEV. 23.487096

Lane Pach/ Parratt Wolff

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	RQD (FT.)	RECOVERY (%)	RQD (%)	PID (ppm) or FID (ppm)	USCS	AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0			4		100						ASPHALT; black w/ f-c gravel	EL. 23.0
1						0.0		SW			F-M SAND, trace clay, silt; gray; moist	Collected SWMU 336-SB04-00 (0'-1')
2	DP-1					0.0		CL			F. CLAY, some silt; stiff, some plasticity; gray	EL. 22.5
3						0.0					CLAY, some silt; stiff, some plasticity; mottled gray, orange and brown	EL. 21.5
4	4.0					0.0						
5			3.8		95	0.0					Some black f-m sand; trace organic debris	Collected SWMU 336-SB04-02 (3'-5') EL. 18.5
6	DP-2					0.0						
7						0.0						
8	8.0					0.0					some f. gray sand; moist	EL. 18.0
9			3.1		78	0.0		SP			F. SAND, some clay; some plasticity; gray and dark gray; moist	EL. 15.5 Collected SWMU 336-SB04-04 (7'-9')
10	DP-3					0.1						
11												
12	12.0										F-M SAND, quartzite grains; subrounded; gray; moist to wet	EL. 12.0
13	13.0		3.9		98	0.0						
14	DP-4 F-1					0.1					F-M SAND; loose, subrounded; gray; moist to wet	Groundwater grab sample for VOC's 336-GW04 from 12' to 16' bgs EL. 10.2 PID @ 13.3: hs=SW
15						0.0						
16	16.0					0.1						
17			3.2		80	0.0						
18	DP-5					0.2						
19						1.0						
						0.2						

BKR_E_PID (LD4)
(02/05 Baker)

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION _____ OFFSET _____ BASELINE _____

COORDINATES: NORTH: 353735.5808 EAST: 2465255.584

INSPECTOR (SIGNED) J. Rodzankas

DRILLERS NAME/COMPANY

BORING NO. 336-GW05

SHEET 1 OF 2

DATE: START 2/1/2005

END 2/1/2005

O.G. ELEV. 23.420829

Chip LeFever/ Parratt Wolff

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: 11.0 TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES): _____

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	RQD (FT.)	RECOVERY (%)	RQD (%)	PID (ppm) or FID (ppm)	USCS	AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0			3.7	92							ASPHALT	EL. 23.1
1						0.0		CL			SAND and GRAVEL (SUBBASE)	EL. 22.6
2	DP-1					185					CLAY, little silt, lenses of f-m sand, dk. gray, brown, orange an orangish brown; moist; (fill)	Collected SWMU 336-SB05-01 (1'-2')
3						59						
4						6.7						
4.0			4	100								
5						33						
6	DP-2					15						Collected SWMU 336-SB05-02 (3'-5')
7						10.6		ML				
8						2.9					SILT, trace to little clay, trace f. sand; orangish brown to light gray; moist	EL. 16.4
8.0			3	75								
9						<1.0						
10	DP-3					<1.0						
11						<1.0		SW-SM				Collected SWMU 336-SB05-05 (9'-11')
12											F. SAND, little med. sand, trace to little silt; gray; wet	EL. 12.4
12.0												
13												
14	F-1										Clear	Purged 0.5 gal. SWMU 336-GW05 (12'-16') EL. 9.4
15												
16			3	75								
16.0						<1.0						
17												
18	DP-4					<1.0		SP-SM				
19						<1.0					F. SAND, little silt; greenish gray; wet	EL. 5.4

BKR_E_PID (LD4)
(02/05 Baker)

LOCATION: MCB Camp Lejeune

STATION	OFFSET	BASELINE
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COORDINATES: NORTH: 353735.5808 EAST: 2465255.584

INSPECTOR (SIGNED)	J. Rodzankas	DRILLERS NAME/COMPANY
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EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: 11.0 TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES):

BORING NO. 336-GW05

SHEET 2 OF 2

DATE: START 2/1/2005

END 2/1/2005

O.G. ELEV.	23.420829
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Chip LeFever/ Parratt Wolff

[illegible]

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION	OFFSET
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COORDINATES: NORTH: 353473.5249 EAST: 2465192.042

INSPECTOR (SIGNED) J. Rodzankas

DRILLERS NAME/COMPANY

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ **DEPTH:** _____ **WATER: DEPTH:** _____ **TIME:** _____ **DATE:** _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 **FILE:** MCB **NOT ENCOUNTERED** ☐ **INCLINATION (DEGREES):** _____

BORING NO. 336-GW08

SHEET 1 OF 2

DATE: START 2/4/2005

END 2/4/2005

O.G. ELEV. 24.220768

Chip LeFever/ Parratt Wolff

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.) ----- RQD (FT.) RECOVERY (%) ----- RQD (%)	PID (ppm) or FID (ppm) .	USCS ----- AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0								
1								
2								
3								
4								
5								
6	X-1							
7								
8								
9								
10								
11								
12	12.0							
13	F-1						Clear	EL. 12.2 Purged approx. 0.25 gal. Collected SWMU 336-GW08 (12' 16')
14								
15								
16	16.0							
17								
18								
19	X-2							

BKR_E_PID (LD4)
(02/05 Baker)

ENGINEERS FIELD BORING LOG

PROJECT NAME CTO-0091/RFI SWMU 336

LOCATION: MCB Camp Lejeune

STATION _____ OFFSET _____ BASELINE _____

COORDINATES: NORTH: 353577.5866 EAST: 2465333.533

INSPECTOR (SIGNED) J. Rodzankas

DRILLERS NAME/COMPANY

Chip LeFever/ Parratt Wolff

EQUIPMENT USED Ingersoll-Rand A300

DRILLING METHODS Direct Push

CASING: SIZE: _____ DEPTH: _____ WATER: DEPTH: 12.0 TIME: _____ DATE: _____

CHECKED BY: _____ DATE: _____ DEPTH: _____ TIME: _____ DATE: _____

S.O. NUMBER: 104559 FILE: MCB NOT ENCOUNTERED ☐ INCLINATION (DEGREES): _____

BORING NO. 336-SB09

SHEET 1 OF 2

DATE: START 2/2/2005

END 2/2/2005

O.G. ELEV. 24.605003

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.)	RQD (FT.)	RECOVERY (%)	RQD (%)	PID (ppm) or FID (ppm)	USCS	AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0											CONCRETE	
1			3		100			CL			1.0	EL. 23.8
2	DP-1						<1.0	SM			CLAY, little silt, trace f. sand; lt brown; moist (fill)	
3							<1.0				2.3	EL. 22.3
4							<1.0				F. SAND, some silt, trace clay; lt brown to brown; moist	
5			4		100		<1.0					
6	DP-2						<1.0					
7							<1.0	SP-SM			Color changes to gray and sand content increases from 6.4' to 7.0'	EL. 18.2
8							<1.0				7.0	EL. 17.6
9			2.3		57		<1.0				F. SAND and SILT, trace clay; yellowish orange; moist	EL. 16.8
10	DP-3						<1.0				7.8	PID @ 7.8: hs=SM
11							<1.0				F. SAND, little silt, trace clay; gray; moist	EL. 15.6
12							<1.0				Increased silt content 9' to 9.5'	
13											Wet at approx. 12'	EL. 12.6
14	F-1										Turbid orangish color, slow recharge	EL. 11.6
15	F-1											Purged approx. 0.25 gal. Collected SWMU 336-GW09
16			3		75			SW			16.0	EL. 8.6
17											F. SAND little to some med. sand; gray; wet	
18	DP-4						<1.0					
19							<1.0					
							<1.0					

BKR_E_PID (LD4)
(02/05 Baker)

INCLINATION (DEGREES): _____

O.G. ELEV. 23.639095

Chip LeFever/ Parratt Wolff

DEPTH (FT.)	SAMPLE NO. AND TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FT.) ----- RQD (FT.) RECOVERY (%) ----- RQD (%)	PID (ppm) or FID (ppm) .	USCS ----- AASHTO	H ₂ O CONTENT	DESCRIPTION	REMARKS
0								
1								
2								
3								
4								
5								
6	X-1							
7								
8								
9								
10								
11								
12								
12.0								
13	F-1						Clear	EL. 11.8 Purged approx. 0.25 gal. Collected SWMU 336-GW10, GW10D (12' 16')
14								
15								
16								
16.0								
17								
18								
19	X-2							

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) LEWIS LEFEVER CERTIFICATION # 2480

WELL CONTRACTOR COMPANY NAME PARRATT-WOLFF, INC. PHONE # (919) 644-2814

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:

Nearest Town: JACKSONVILLE County ONslow
MARINE CORPS AIR STATION - CAMP LEJEUNE
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☐ Slope ☐ Valley ☐ Flat
(check appropriate box)

Latitude/longitude of well location
N34 44.20'/W77 27.34'

(degrees/minutes/seconds)

Latitude/longitude source: ☐ GPS ☐ Topographic map
(check box)

3. OWNER: US MARINE CORPS

Address _____
(Street or Route No.)
JACKSONVILLE NC 28547
City or Town State Zip Code

Area code- Phone number
() - _____

4. DATE DRILLED 2/7/05

5. TOTAL DEPTH: 18.0'

6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: 8.0 FT.
(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 0 FT. Above Land Surface*

*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

DEPTH DRILLING LOG
From To Formation Description

NO SAMPLES TAKEN

11. DISINFECTION: Type N/A Amount N/A

12. CASING: Wall Thickness
Depth Diameter or Weight/Ft. Material
From 0 To 8 Ft. 1" SCH 40 PVC
From _____ To _____ Ft. _____ _____
From _____ To _____ Ft. _____ _____

13. GROUT: Depth Material Method
From 0 To 1 Ft. PORTLAND TREMIE
From 1 To 6 Ft. BENTONITE TREMIE

14. SCREEN: Depth Diameter Slot Size Material
From 8 To 18 Ft. 1 in. .010 in. PVC
From _____ To _____ Ft. _____ in. _____ in. _____

15. SAND/GRAVEL PACK: Depth Size Material
From 6 To 18 Ft. #1 SAND
From _____ To _____ Ft. _____ _____

16. REMARKS: 336-PZ1

LOCATION SKETCH
Show direction and distance in miles from at least two State Roads or County Roads. Include the road numbers and common road names.

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

[Signature] 3-2-05
SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC 27699-1636 Phone No. (919) 733-3221, within 30 days. GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) LEWIS LEFEVER CERTIFICATION # 2480

WELL CONTRACTOR COMPANY NAME PARRATT-WOLFF, INC. PHONE # (919) 644-2814

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:

Nearest Town: JACKSONVILLE County ONSLOW
MARINE CORPS AIR STATION - CAMP LEJEUNE
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☐ Slope ☐ Valley ☐ Flat
(check appropriate box)

Latitude/longitude of well location

N34 44.20'W77 27.34'

(degrees/minutes/seconds)

Latitude/longitude source: ☐ GPS ☐ Topographic map
(check box)

3. OWNER: US MARINE CORPS

Address _____

(Street or Route No.)

JACKSONVILLE NC 28547
City or Town State Zip Code

() -

Area code- Phone number

4. DATE DRILLED 2/7/05

5. TOTAL DEPTH: 18.0'

6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: 8.0 FT.

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 0 FT. Above Land Surface*

*Top of casing terminated at/or below land surface requires a
variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

DEPTH DRILLING LOG
From To Formation Description

NO SAMPLES TAKEN

LOCATION SKETCH

Show direction and distance in miles from at least
two State Roads or County Roads. Include the road
numbers and common road names.

11. DISINFECTION: Type N/A Amount N/A

12. CASING:

From	To	Depth	Diameter	Wall Thickness	Material
From 0	To 8	Ft. 1"	SCH 40	PVC	
From	To	Ft.			
From	To	Ft.			

13. GROUT: Depth Material Method

From	To	Depth	Material	Method
From 0	To 1	Ft. PORTLAND	TREMIE	
From 1	To 6	Ft. BENTONITE	TREMIE	

14. SCREEN: Depth Diameter Slot Size Material

From	To	Depth	Diameter	Slot Size	Material
From 8	To 18	Ft. 1 in.	.010 in.	PVC	
From	To	Ft.	in.	in.	

15. SAND/GRAVEL PACK:

From	To	Depth	Size	Material
From 6	To 18	Ft. #1	SAND	
From	To	Ft.		

16. REMARKS: 336-PZ12

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL
CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER


SIGNATURE OF PERSON CONSTRUCTING THE WELL

3-2-05
DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC
27699-1636 Phone No. (919) 733-3221, within 30 days.

GW-1 REV. 07/2001

WELL CONSTRUCTION RECORD

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section

WELL CONTRACTOR (INDIVIDUAL) NAME (print) LEWIS LEFEVER CERTIFICATION # 2480

WELL CONTRACTOR COMPANY NAME PARRATT-WOLFF, INC. PHONE # (919) 844-2814

STATE WELL CONSTRUCTION PERMIT# _____ ASSOCIATED WQ PERMIT# _____
(if applicable) (if applicable)

1. WELL USE (Check Applicable Box): Residential ☐ Municipal/Public ☐ Industrial ☐ Agricultural ☐
Monitoring ☒ Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use _____

2. WELL LOCATION:

Nearest Town: JACKSONVILLE County ONSLOW
MARINE CORPS AIR STATION - CAMP LEJEUNE
(Street Name, Numbers, Community, Subdivision, Lot No., Zip Code)

Topographic/Land setting
☐ Ridge ☐ Slope ☐ Valley ☐ Flat
(check appropriate box)

Latitude/longitude of well location
N34 44.20'W77 27.34'

(degrees/minutes/seconds)

Latitude/longitude source: ☐ GPS ☐ Topographic map
(check box)

3. OWNER: US MARINE CORPS

Address _____
(Street or Route No.)
JACKSONVILLE NC 28547
City or Town State Zip Code

DEPTH

From To

DRILLING LOG

Formation Description

Area code- Phone number

4. DATE DRILLED 2/7/05

5. TOTAL DEPTH: 16.0'

6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

7. STATIC WATER LEVEL Below Top of Casing: 6.0 FT.

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 0 FT. Above Land Surface*

*Top of casing terminated at/or below land surface requires a
variance in accordance with 15A NCAC 2C .0118.

9. YIELD (gpm): N/A METHOD OF TEST N/A

10. WATER ZONES (depth): N/A

11. DISINFECTION: Type N/A Amount N/A

12. CASING: Wall Thickness

From	To	Depth	Diameter	or Weight/Ft.	Material
From <u>0</u>	To <u>6</u>	Ft. <u>1"</u>	<u>SCH 40</u>	<u>PVC</u>	
From _____	To _____	Ft. _____	_____	_____	
From _____	To _____	Ft. _____	_____	_____	

13. GROUT: Depth Material Method

From	To	Depth	Material	Method
From <u>0</u>	To <u>1</u>	Ft. <u>PORTLAND</u>	<u>TREMIE</u>	
From <u>1</u>	To <u>4</u>	Ft. <u>BENTONITE</u>	<u>TREMIE</u>	

14. SCREEN: Depth Diameter Slot Size Material

From	To	Depth	Diameter	Slot Size	Material
From <u>6</u>	To <u>16</u>	Ft. <u>1</u>	<u>in.</u>	<u>.010</u>	<u>in.</u>
From _____	To _____	Ft. _____	_____	_____	_____

15. SAND/GRAVEL PACK:

From	To	Depth	Size	Material
From <u>4</u>	To <u>16</u>	Ft. <u>#1</u>	<u>SAND</u>	
From _____	To _____	Ft. _____	_____	

16. REMARKS: 336-PZ# 10

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL
CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SIGNATURE OF PERSON CONSTRUCTING THE WELL

DATE

Submit the original to the Division of Water Quality, Groundwater Section, 1636 Mail Service Center - Raleigh, NC
27699-1636 Phone No. (919) 733-3221, within 30 days. GW-1 REV. 07/2001

Baker

Baker Environmental, Inc.

APPENDIX B

Chain-of-Custody Forms



340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE BEAR DOWN AND
PRINT LEGIBLY IN PEN

Page 1 of 1

Client

BALLO Environmental, Inc.

Contact

Rob Sisk

Phone #

(412) 297-1734

Fax #

()

Address

100 AUGUST DRIVE

City

Mon Township

State

PA

Zip Code

15108

Purchase Order #

Proj. Name / No.

Katahdin Quote #

Bill (if different than above)

CHERRY HILL

Address

Sampler (Print / Sign)

Robert M. Sisk, Jr.

Copies To

ADRIANNE JONES

LAB USE ONLY

WORK ORDER #:

KATAHDIN PROJECT NUMBER

REMARKS:

SHIPPING INFO:

☐ FED EX

☐ UPS

☐ CLIENT

AIRBILL NO:

TEMP °C

☐ TEMP BLANK

☐ INTACT

☐ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	Filt.									
					OY	ON	OY	ON	OY	ON	OY	ON	OY	ON
	TE02-020205	2-2-05/NA	water	2	X									
	SWMU318-CW33B	2-2-05/1205	water	2		X								
	SWMU318-CW34	2-2-05/1405	water	2		X								
	SWMU336-CW41-01	2-2-05/1005	water	3	X									
	ER01-020205	2-2-05/1100	water	5	X	X								
	SWMU336-SB09-00	2-2-05/0910	Soil	1			X							
	SWMU318-CW57	2-3-05/0805	water	5	X	X								
	SWMU318-CW36	2-3-05/1010	water	2		X								
	SWMU318-SB21-00	2-3-05/1040	Soil	2		X	X							
	SWMU318-SB21-02	2-3-05/1050	Soil	4	X		X							
	SWMU318-SB21-04	2-3-05/1050	Soil	1		X								
	SWMU318-SB23-00	2-3-05/0825	Soil	1		X								
	SWMU318-SB23-02	2-3-05/0940	Soil	5	X	X	X							
	SWMU318-SB23-04	2-3-05/0900	Soil	1			X							
	SWMU318-SB20-00	2-3-05/0730	Soil	3	X									
	SWMU318-SB20-02	2-3-05/1000	Soil	2		X	X							
	SWMU318-SB20-04	2-3-05/0750	Soil	2		X	X							

Relinquished By: (Signature)

Relinquished By: (Signature)

Date / Time

2-3-05 1000

Date / Time

Received By: (Signature)

Received By: (Signature)

Relinquished By: (Signature)

Relinquished By: (Signature)

Date / Time

Date / Time

Received By: (Signature)


Received By: (Signature)

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN
SERVICES, EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS

340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

**PLEASE BEAR DOWN AND
PRINT LEGIBLY IN PEN**

Page 1 of 1[illegible]

Date / Time 2/1/05 1700	Received By: (Signature) 	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN SERVICES, EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS.

CUSTOMER

CHAIN of CUSTODY

**PLEASE BEAR DOWN AND
PRINT LEGIBLY IN PEN**

Page 1 of 1

Client Baker Environmental Inc.		Contact Robert Sak		Phone # (412) 897-1934		Fax #								
Address 100 Airside Drive		City Moon Twp		State PA		Zip Code 15108								
Purchase Order #		Proj. Name / No. CTO-0091 RRA Camp Lejeune		Katahdin Quote #										
Bill (if different than above) Adrienne Jones (Hill)		Address												
Sampler (Print / Sign) Robert M. Sak				Copies To: Adrienne Jones										
LAB USE ONLY		WORK ORDER #		ANALYSIS AND CONTAINER TYPE PRESERVATIVES										
		KATAHDIN PROJECT NUMBER		Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON	Filt. OY ON
REMARKS:				TEL VOCs	TEL SVOCs	TEL RRA Metals	TOC							
SHIPPING INFO: <input checked="" type="checkbox"/> FED EX <input type="checkbox"/> UPS <input type="checkbox"/> CLIENT														
AIRBILL NO: 8456 3095 3174														
TEMP °C <input type="checkbox"/> TEMP BLANK <input type="checkbox"/> INTACT <input type="checkbox"/> NOT INTACT														
*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.										
	SWMU318-5823-02	2/3/05/0840	Soil	1				X						
	SWMU318-GW31	2/3/05/1555	Water	3	X									
	SWMU318-5826-01	2/4/05/1015	Soil	2		X	X							
	SWMU318-5826-02	2/4/05/1020	Soil	5	X	X	X							
	SWMU318-5816-00	2/4/05/1155	Soil	5	X	X	X							
	SWMU318-5816-02	2/4/05/1215	Soil	2		X	X							
	SWMU318-GW33-01	2/4/05/0900	Water	3	X									
	SWMU318-GW32	2/3/05/1420	Water	2		X								
	SWMU318-GW31	2/3/05/1555	Water	2		X								
	SWMU318-GW33	2/4/05/0840	Water	2		X								
	ER02 020405	2/4/05/1140	Water	6	X	X	X							
	TBOX3 020405	2/4/05/NA	Water	2	X									
	/	/	/	/										
	/	/	/	/										
	/	/	/	/										
	/	/	/	/										
COMMENTS Please take VOCs moisture from SUB jars / will collect 207 jar next time														
Relinquished By: (Signature)		Date / Time		Received By: (Signature)		Relinquished By: (Signature)		Date / Time		Received By: (Signature)				
Relinquished By: (Signature)		Date / Time		Received By: (Signature)		Relinquished By: (Signature)		Date / Time		Received By: (Signature)				

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN SERVICES, EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS.

CUSTOMER COPY

CHAIN of CUSTODY

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Page 1 of 3

Client: Baker Environmental Inc.		Contact: Robert Sok		Phone #: (412) 897-1934		Fax #:									
Address: 100 Airside Drive		City: Mon Twp.		State: PA		Zip Code: 15107									
Purchase Order #:		Proj. Name / No.: RRA Compliance TO 5071		Katahdin Quote #:											
Bill (if different than above): CHAM HILL		Address:													
Sampler (Print / Sign): Robert M. Sok				Copies To:											
LAB USE ONLY		WORK ORDER #:		ANALYSIS AND CONTAINER TYPE PRESERVATIVES											
REMARKS:		KATAHDIN PROJECT MANAGER:		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON											
SHIPPING INFO:		<input type="checkbox"/> FED EX <input type="checkbox"/> UPS <input type="checkbox"/> CLIENT		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON											
AIRBILL NO:		TEMP °C		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON											
<input type="checkbox"/> TEMP BLANK <input type="checkbox"/> INTACT <input type="checkbox"/> NOT INTACT				Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON											
* Sample Description		Date / Time coll'd		Matrix		No. of Cntrs.		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
TB04 020805		2/8/05		WATER		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-000		2/8/05/0940		Soil		34		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-01		2/8/05/0940		Soil		6		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-02		2/8/05/1025		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-020		2/8/05/1025		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-04		2/8/05/1030		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-040		2/8/05/1030		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB25-04		2/8/05/1030		Soil		4		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB28-02		2/8/05/1115		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB28-020		2/8/05/1115		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB28-04		2/8/05/1120		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB28-040		2/8/05/1120		Soil		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-SB28-04		2/8/05/1120		Soil		4		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-GW35-01		2/5/05/1140		Water		3		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-GW35		2/5/05/1105		Water		2		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
SWMU318-GW51-01		2/7/05/1035		Water		3		Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON Filt. OYON							
COMMENTS:															
Relinquished By: (Signature)		Date / Time		Received By: (Signature)		Relinquished By: (Signature)		Date / Time		Received By: (Signature)					
Relinquished By: (Signature)		Date / Time		Received By: (Signature)		Relinquished By: (Signature)		Date / Time		Received By: (Signature)					

CUSTOMER



340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

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Page 2 of 3

Client	Baker Environmental Inc.	Contact	Robert Sok	Phone #	(412) 897-1134	Fax #	()
Address	100 Airside Drive	City	Mon Twp	State	PA	Zip Code	15108
Purchase Order #		Proj. Name / No.	PCRA Compliance	CTO	0091	Katahdin Quote #	
Bill (if different than above)	CH2M Hill	Address					
Sampler (Print / Sign)	Robert M. Sok	Copies To:	Adrienne Jones				

LAB USE ONLY

WORK ORDER #:

KATAHDIN PROJECT NUMBER

REMARKS:

SHIPPING INFO: ☒ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: 8456 3095 3196

TEMP °C ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	ANALYSIS AND CONTAINER TYPE PRESERVATIVES									
					TEL VOLs	TEL SVOCs	PCRA Metals	TOL						
	ER03 020605	2/6/05/1700	Water	6	X	X	X							
	ER04 020805	2/8/05/1415	Water	6	X	X	X							
	SWMU318-SB18-01	2/7/05/1055	Soil	1				X						
	SWMU318-SB18-02	2/7/05/1045	Soil	2		X	X							
	SWMU318-SB18-03	2/7/05/1050	Soil	2		X	X							
	SWMU318-SB17-00	2/4/05/1625	Soil	2		X	X							
	SWMU318-SB19-05	2/4/05/1630	Soil	2		X	X							
	SWMU318-SB15-01	2/5/05/1550	Soil	2		X	X							
	SWMU318-SB15-03	2/5/05/1600	Soil	2		X	X							
	SWMU318-SB14-02	2/5/05/1510	Soil	2		X	X							
	SWMU318-SB14-03	2/5/05/1505	Soil	2		X	X							
	SWMU318-SB17-02	2/5/05/1635	Soil	2		X	X							
	SWMU318-SB17-03	2/5/05/1640	Soil	2		X	X							
	SWMU318-SB22-03	2/7/05/1355	Soil	2		X	X							
	SWMU318-SB22-04	2/7/05/1350	Soil	2		X	X							
	SWMU318-SB24-03	2/7/05/1145	Soil	1				X						

COMMENTS

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
	2/6/05 1800				
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

THE TERMS AND CONDITIONS ON THE REVERSE SIDE HEREOF SHALL GOVERN SERVICES, EXCEPT WHEN A SIGNED CONTRACTUAL AGREEMENT EXISTS.

340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE PRINT IN PEN

Page 2 of 3

[illegible]

CUSTOMER

CHAIN of CUSTODY

PLEASE PRINT IN PEN

Page 1 of 1

Client Raker Environmental Inc.		Contact Rob Sok		Phone # (412) 892-1741		Fax #	
Address 100 Ariside Drive		City Moon Twp.		State PA		Zip Code 15102	
Purchase Order #		Proj. Name / No. CDD-0191 RAA - sample		Katahdin Quote #			
Bill (if different than above) CHERRY HILL				Address			
Sampler (Print / Sign) Robert M. Sok				Copies To: Alvin Jones			

LAB USE ONLY					ANALYSIS AND CONTAINER TYPE PRESERVATIVES											
WORK ORDER #: _____ KATAHDIN PROJECT MANAGER _____					Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON	Filt. OYON
REMARKS:																
SHIPPING INFO: <input checked="" type="checkbox"/> FED EX <input type="checkbox"/> UPS <input type="checkbox"/> CLIENT																
AIRBILL NO: 8456 3015 2925																
TEMP°C <input type="checkbox"/> TEMP BLANK <input type="checkbox"/> INTACT <input type="checkbox"/> NOT INTACT																
*	Sample Description	Date / Time col'd	Matrix	No. of Cntrs.	Turb	Vials	RAA Metals	Wet Metals								
	FB01 - OSA	2/14/05 / 1015	W	6	x	x	x									
	FB02 - OSA	2/14/05 / 1020	W	6	x	x	x									
	FB03 - OSA	2/14/05 / 1030	W	6	x	x	x									
	TE01 - WAF	2/14/05 / NA	W	3	x											
	26-WA17I-1-OA	2/14/05 / 0215	W	6	x	x	x	x								
	26-WA21EW-OA	2/14/05 / 1145	W	6	x	x	x	x								
	26-WA17IW-OA m.	2/14/05 / 1155	W	6	x	x	x									
	26-WA21EW-OA m.d	2/14/05 / 1145	W	6	x	x	x									
	26-MWA04-OA	2/14/05 / 1115	W	6	x	x	x	x								
	26-MWA04A-OA	2/14/05 / 1115	W	6	x	x	x									
	26-BU172IW-OA	2/14/05 / 1535	W	6	x	x	x	x								
	26-MWA05-OA	2/14/05 / 1710	W	6	x	x	x	x								
	26-MWA02-OA	2/14/05 / 0910	W	6	x	x	x	x								
	26-MWA03-OA	2/14/05 / 0910	W	6	x	x	x									
	26-SAW27EW-OA	2/14/05 / 1120	W	6	x	x	x	x								
	26-MWA03-OA	2/14/05 / 1315	W	6	x	x	x	x								

COMMENTS

Relinquished By: (Signature) 	Date / Time 2/14/05	Received By: (Signature) 	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE PRINT IN PEN

Page 2 of 2

Client Parker Environmental Inc.	Contact Rob Cook	Phone # (412) 252-1901	Fax # ()
Address 100 Arside Drive	City Moon Twp.	State PA	Zip Code 15112
Purchase Order #	Proj. Name / No. C7-031-001 Capital	Katahdin Quote #	
Bill (if different than above) CH 17 HLL	Address		
Sampler (Print / Sign) Robert M. Cook II		Copies To: <i>[Signature]</i>	

[illegible]

COMMENTS					
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)



340 County Road No. 5
P.O. Box 720
Westbrook, ME 04092
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

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Page 1 of 1

Client	Baker Environmental Inc.	Contact	Rob Sok	Phone #	(412) 877-1934	Fax #	
Address	100 Airside Drive	City	Moan Twp	State	PA	Zip Code	15108
Purchase Order #		Proj. Name / No.	CTO-0091, RURA-Camp	Katahdin Quote #			
Bill (if different than above)	CHM Hill	Address					
Sampler (Print / Sign)	Robert M. Sok II	Copies To:	Adrienne Jones				

LAB USE ONLY

WORK ORDER #:

KATAHDIN PROJECT MANAGER

REMARKS:

SHIPPING INFO: ☒ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: 8456 3095 2958

TEMP°C ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

Filt.	Filt.	Filt.	Filt.	Filt.	Filt.	Filt.	Filt.	Filt.	Filt.
OYON	OYON	OYON	OYON	OYON	OYON	OYON	OYON	OYON	OYON

TEL Vols	TEL SVOLs	RURA Metals	Diss Gases						
----------	-----------	-------------	------------	--	--	--	--	--	--

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	TEL Vols	TEL SVOLs	RURA Metals	Diss Gases						
	SWMU318-MW08-OSA	2/19/05/0920	W	8	X	X	X	X						
	SWMU318-MW08-OSA MS	2/19/05/0920	W	5	X	X								
	SWMU318-MW08-OSA MSO	2/19/05/0920	W	5	X	X								
	SWMU318-MW07-OSA	2/19/05/1110	W	8	X	X	X	X						
	SWMU318-MW06OW-OSA	2/19/05/1230	W	8	X	X	X	X						
	SWMU318-MW06-OSA	2/19/05/1335	W	8	X	X	X	X						
	SWMU318-MW04OW-OSA	2/19/05/1455	W	8	X	X	X	X						
	SWMU318-MW05OW-OSA	2/20/05/0915	W	8	X	X	X	X						
	SWMU318-MW05OW-OSAD	2/20/05/0915	W	6	X	X	X							
	EROS-OSA	2/20/05/1515	W	6	X	X	X							
	TB05-022005	2/20/05/NA	W	2	X									
	/	/												
	/	/												
	/	/												
	/	/												
	/	/												
	/	/												

COMMENTS

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

CUSTOMER



LANDMARK
LABORATORY & FIELD SERVICES DIVISION

CHAIN-OF-CUSTODY RECORD

02511

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name CTO-0091 RCRA Comp Levee		Project Location		Number of Containers		Analysis Desired (Indicate separate containers) <i>860 WDC</i>										Due Date:		
Project No. 104559		Client/Project Contact														Project Telephone No.		<input type="checkbox"/> Rush
																Project Fax No.		<input type="checkbox"/> Standard
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (include matrix and point of sample)										Remarks		
1	SWMU 336-GW01	02/05	1155													05012-D1		
2	SWMU 336-GW01-01		1230													02		
3	SWMU 336-GW04-01		1220													03		
4	SWMU 336-SB01-00		1100													04		
5	SWMU 336-SB01-02		1120													05		
6	SWMU 336-SB01-04		1130													06		
7	SWMU 336-SB04-00		1145													07		
8	SWMU 336-SB04-02		1150													08		
9	SWMU 336-SB04-04	✓	1205													09		
10																		
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Blank information or other instructions - please print)										
1	1-9			<i>[Signature]</i>														
2		<i>[Signature]</i>		<i>[Signature]</i>														
3								Sampler's Signature										
4								Print Name										



LANDMARK
LABORATORY & FIELD SERVICES DIVISION

CHAIN-OF-CUSTODY RECORD

02512

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411										WORK ORDER NO.																
Project Name CTO-0091 RCRA COMPLIANCE					Project Location					Number of Containers	Analysis Desired (Indicate separate containers) <i>3260 VV</i>										Due Date:					
Project No. 104559					Client/Project Contact																Project Telephone No.					<input type="checkbox"/> Rush
																					Project Fax No.					<input type="checkbox"/> Standard
Item No	Sample Number	Date	Time	Comp	Grab	Sample Description (include matrix and point of sample)					Remarks															
1	SWMU 336 SB05-01	2-1-05	1430								05012-10															
2	SWMU 336 SB05-02		1432								11															
3	SWMU 336 SB05-05		1440								12															
4	SWMU 336 GW05		1500								13															
5	SWMU 336 GW05-01		1550								14															
6	SWMU 336 GW04		1400								15															
7	SWMU 318- GW 41		1525								16															
8	SWMU 318- GW 41-02		1730								17															
9	<i>Hand Delivered</i>																									
10																										
Transfer Number	Item Number	Transfers Relinquished by			Transfers Accepted by			Date	Time	Remarks (Billing Information or other instructions - please print)																
1	1-5	<i>[Signature]</i>			<i>[Signature]</i>			02/01/05	1400	<i>[Signature]</i>																
2	6-7	<i>[Signature]</i>			<i>[Signature]</i>			02/01/05	1740																	
3										Sampler's Signature																
4										Print Name																



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CHAIN-OF-CUSTODY RECORD

02513

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411									
Project Name		Project Location		Project Telephone No.		Project Fax No.		WORK ORDER NO.	
c70-0091 RCRA		Benton Harbor		616-927-3004		616-927-3411			
Project No.		Client/Project Contact		Project Telephone No.		Project Fax No.		Analysis Desired (Indicate separate containers)	
104559								8818	
Item No.	Sample Number	Date	Time	Comp	Lab	Sample Description (Include matrix and point of sample)	Number of Containers	Remarks	Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard
1	SWMU 318-6W40-01	6/26/01	0830		X		3		2.5.012-18
2	SWMU 330-6W40-01		0730		X		3		19
3	SWMU 330-6W40-01		1005				3		20
4	SWMU 330-6W40-01		0900				1		21
5	SWMU 330-6W40-01		0905				1		22
6	SWMU 330-6W40-01		0910				1		23
7	SWMU 318-6W40-01		0930				3		24
8	SWMU 318-6W40-01		0950				3		25
9	SWMU 318-6W40-01		1100				3		26
10									
Transfer Number		Item Number	Transfers Relinquished by		Transfers Accepted by		Remarks (Billing information or other instructions - please print)		
1	1		Dan Tansph		Hand Delivered				
2	2-6		Dan Tansph		Hand Delivered				
3	7-8		Dan Tansph		Hand Delivered				
4	9		Dan Tansph		Hand Delivered				
							Sampler's Signature		
							Print Name		
							Dan Tansph		
							Dan Tansph		



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LABORATORY & FIELD SERVICES DIVISION

02514

Project Name CTD-0091 RCRA CAMP				Project Location RCRA CAMP				Project Telephone No. 104559				Project Fax No.				WORK ORDER NO.															
Project No.				Client/Project Contact				Project Telephone No.				Project Fax No.				Analysis Desired (Indicate separate containers)				Number of Containers				Remarks				Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard			
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (include matrix and point of sample)		Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)																	
1	SWMU318-GW43	2/2/05	1145		✓	groundwater		[Signature]		[Signature]		020205	1340	3		05012-27															
2	SWMU318-GW43-01	2/2/05	1205		✓	groundwater		[Signature]		[Signature]		020205	1350	3		28															
3	SWMU318-GW43-02	2/2/05	1230		✓	groundwater		[Signature]		[Signature]		020205	1445	3		29															
4	SWMU318-GW38	2/2/05	1205		✓			[Signature]		[Signature]		020205	1352	3		30															
5	SWMU318-GW38-01	2/2/05	1255		✓			[Signature]		[Signature]		020205	1352	3		31															
6	SWMU318-GW38-01Q	2/2/05	1255		✓			[Signature]		[Signature]		020205	1352	3		32															
7	SWMU318-GW38-02	2/2/05	1352		✓			[Signature]		[Signature]		020205	1445	3		33															
8																															
9																															
10																															
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date		Time		Remarks (Billing information or other instructions - please print)																					
1	1-3	[Signature]		[Signature]		020205		1340																							
2	4-6	[Signature]		[Signature]		020205		1350																							
3	7	[Signature]		[Signature]		020205		1445																							
4																															



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CHAIN-OF-CUSTODY RECORD

02515

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WORK ORDER NO.

Project Name CTO-0091 RCRA CAMP		Project Location Leeland		Analysis Desired (Indicate separate containers)		Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard					
Project No. 014559	Client/Project Contact	Project Telephone No.									
Project Fax No.											
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Number of Containers	Remarks			
1	SWMU318-GW34	2/2/05	1405		✓	groundwater sample	3	✓			05012-34
2	SWMU318-GW34-01	2/2/05	1430		✓		3	✓			35
3	SWMU318-GW34-02	2/2/05	1515		✓		3	✓			36
4	SWMU318-GW34-01D	2/2/05	1435		✓		3	✓			37
5	SWMU318-GW39	2/2/05	1500		✓		3	✓			38
6	SWMU318-GW39-01	2/2/05	1515		✓		3	✓			39
7	SWMU318-GW39-02	2/2/05	1535		✓		3	✓			40
8											
9											
10											
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)			
1	1-4	D. T. [Signature]		[Signature]		02/02/05	1545	Sampler's Signature: [Signature] Print Name: [Signature]			
2	5-7	[Signature]		[Signature]		02/02/05	1530				
3											
4											



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LABORATORY & FIELD SERVICES DIVISION

02516

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411										
Project Name		Project Location		Project Telephone No.		Project Fax No.		WORK ORDER NO.		
Project No.		Client/Project Contact		Project Telephone No.		Project Fax No.		WORK ORDER NO.		
014559		CAMP LAKEVIEW		014559		014559		02516		
Item No.	Sample Number	Date	Time	Grab	Comp	Sample Description (Include matrix and point of sample)	Number of Containers	Analysis Desired (Indicate separate containers)	Remarks	Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard
1	SWMU 318-GW37	9/9/05	0835	✓				✓	05-012-41	
2	SWMU 318-GW37-01	9/9/05	0850	✓				✓	42	
3	SWMU 318-GW37-02	9/9/05	0910	✓				✓	43	
4	SWMU 318-GW36		1010	✓				✓	44	
5	SWMU 318-GW36-01		1035	✓				✓	45	
6	SWMU 318-GW36-02		1100	✓				✓	46	
7	SWMU 318-GW36-02D		1100	✓				✓	47	
8	SWMU 318-GW42		1235	✓				✓	48	
9	SWMU 318-GW42-01		1250	✓				✓	49	
10	SWMU 318-GW42-02		1315	✓				✓	50	
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date		Time		Remarks (Billing information or other instructions - please print)
1	1-3					9/20/05		1045		Hand Delivered
2	4-7					9/20/05		1130		
3	8-10					9/20/05		1400		
4										

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name CAMP		Project Location Leisure		Project Telephone No.		Project Fax No.		Sample Description (include matrix and point of sample)		Number of Containers		Analysis Desired (Indicate separate containers)		Remarks	
Project No. 010-00918184		Client/Project Contact 014559		Project Telephone No.		Project Fax No.		Sample Description (include matrix and point of sample)		Number of Containers		Analysis Desired (Indicate separate containers)		Remarks	
Item No.	Sample Number	Date	Time	Comp	Grab										
1	SWM-318-00	0930	05											05018-17	
2	SWM-318-02	0930	05											53	
3	SWM-318-04	0950	21											53	
4	SWM-318-00	1010	21											54	
5	SWM-318-02	1050	21											55	
6	SWM-318-04	1105	21											56	
7	SWM-318-00	0825	21											57	
8	SWM-318-02	0840	21											58	
9	SWM-318-04	0900	21											59	
10															
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)		Sampler's Signature		Print Name			
1	1-9	B. Villa		J. Villa		0930	05	Handed to J. Villa		Don Long		Don Long			

**LANDMARK**
LABORATORY & FIELD SERVICES DIVISION**CHAIN-OF-CUSTODY RECORD**

02518

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name CTO-1091 RCRA LEACHUR CAMP		Project Location		Analysis Desired (Indicate separate containers)		Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard		
Project No. 014559	Client/Project Contact	Project Telephone No.						
Project Fax No.								
Number of Containers								
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Remarks	
1	SWMU318-GW45	2/3/05	1335	✓		groundwater samples	05012-60	
2	SWMU318-GW45-01	2/3/05	1355	✓			61	
3	SWMU318-GW45-02	2/3/05	1430	✓			62	
4	SWMU318-GW44	2/3/05	1505	✓			63	
5	SWMU318-GW44-01	2/3/05	1520	✓			64	
6	SWMU318-GW44-02	2/3/05	1540	✓			65	
7	SWMU318-GW44-01D	2/3/05	1525	✓			66	
8								
9								
10								
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)
1	1-7	Don Temp		Paul		2/20/05	1630	
2								
3								Sampler's Signature
4								Print Name

WORK ORDER NO.

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

Project Name <i>Camp</i>		Project Location <i>Camp</i>	
Client/Project Contact <i>CTO - 0091 RCBA / 616-927-3411</i>		Project Telephone No.	
Project Fax No.		Project Telephone No.	
Analysis Desired (Indicate separate containers)	Number of Containers	Sample Description (Include matrix and point of sample)	
		Sample Number	

Item No.	Sample Number	Date	Time	Comp	Grab
1	Summu 318-2-3-05	2/3/05	1420	✓	
2	Summu 318-GW32-01	2/3/05	1445	✓	
3	Summu 318-GW32-02	2/3/05	1510	✓	
4	Summu 318-GW31	2/3/05	1555	✓	
5	Summu 318-GW31-01	2/3/05	1615	✓	
6	Summu 318-GW31-02	2/3/05	1635	✓	
7					
8					
9					
10					

Transfer Number	Item Number	Transfers Relinquished by	Transfers Accepted by	Date	Time	Remarks (Billing information or other instructions - please print)
1	1-6	<i>Officer M. W. H.</i>	<i>Paul</i>	2/23/05	1800	
2						
3						
4						

White: LANDMARK file copy • Yellow: Laboratory copy • Pink: Client copy

Form FS1001 Field-Technical Services Rev.04/97



02520

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name		Project Location		Analysis Desired (Indicate separate containers)		Due Date	
Project No.		Client/Project Contact		Project Telephone No.		Rush	
Project Fax No.		Project Fax No.		Number of Containers		Standard	
CTO - 0091 RCRA Camp Lejeune	014559						
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Remarks
1	SWMU 318-GW33	2/4/05	840		✓		0.5012 - 73
2	SWMU 318-GW33-01	2/4/05	900		✓		74
3	SWMU 318-GW33-02	2/4/05	925		✓		75
4	SWMU 336-GW08	2/4/05	1500		✓		76
5	SWMU 336-GW08-01	2/4/05	1520		✓		77
6	SWMU 336-GW08-010	2/4/05	1520		✓		78
7	SWMU 336-GW10	2/4/05	1410		✓		79
8	SWMU 336-GW10-01	2/4/05	1430		✓		80
9	SWMU 336-GW10-0	2/4/05	1410		✓		81
10							

Hand Delivered

Transfer Number	Item Number	Transfers Relinquished by	Transfers Accepted by	Date	Time	Remarks (Billing information or other instructions - please print)
1	1-3	<i>Jeffrey M. Roddy</i>	<i>Sam</i>	02/04/05	09:00	
2	4-9	<i>[Signature]</i>	<i>Sam</i>	02/04/05	16:20	
3						
4						

Sampler's Signature: *Jeffrey M. Roddy*

Print Name: *Jeffrey M. Roddy*

02521

Project Name: CAMP Project No.: CTO-0091 RCHA LEVINE Client/Project Contact: 014559										Project Location: CAMP		Project Telephone No.: Project Fax No.:		Number of Containers: Analysts Desired (Indicate separate containers): 8260 (2/1/05)		Due Date: Rush <input type="checkbox"/> Standard <input type="checkbox"/>		Remarks:	
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Number of Containers		Remarks										
1	SWMU 318-	10/15					1			05/01/02-82									
2	SWMU 318-	10/15					1												
3	SWMU 318-	10/20					1			83									
4	SWMU 318-	11/55					1			84									
5	SWMU 318-	12/15					1			85									
6	SWMU 318-	12/20					1			86									
7	SWMU 318-	10/25					1			87									
8	SWMU 318-	10/35					1			88									
9	SWMU 318-	10/30					1			89									
10	SWMU 318-	10/30					1			90									
Transfers Relinquished by: <i>[Signature]</i> Transfers Accepted by: <i>[Signature]</i> Date: 12/04/05 Time: 16:00 Sample's Signature: <i>[Signature]</i> Print Name:																			



02522

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name		Project Location		Analysis Desired (Indicate separate containers)		Due Date	
Project No.		Client/Project Contact		Project Telephone No.		Rush	
Project Fax No.				Number of Containers		Standard	
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Remarks
1	SWMU 318 GW48	2/5/05	805		✓		05012-91
2	SWMU 318 GW48-01	2/5/05	825		✓		92
3	SWMU 318 GW48-02	2/5/05	850		✓		93
4	SWMU 318 GW35	4/5/05	1105		✓		94
5	SWMU 318 GW35-01	2/5/05	1120		✓		95
6	SWMU 318 GW35-02	2/5/05	1245		✓		96
7	SWMU 318 SB35-01	2/5/05	1055		✓		97
8	SWMU 318 SB35-02	2/5/05	1105		✓		98
9	SWMU 318 SB35-03	2/5/05	1100		✓		99
10							

Transfer Number

Item Number

Transfers Relinquished by

Transfers Accepted by

Date

Time

Remarks (Billing information or other instructions - please print)

Sampler's Signature

Print Name

02523

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411 WORK ORDER NO.									
Project Name CTO - 0091 KCA CAMP Project Location		Project No. 104557		Client/Project Contact		Project Telephone No.		Project Fax No.	
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (include matrix and point of sample)			
1	SWMU 318	2/5/05	1450	✓					
2	SWMU 318	1510		✓					
3	SWMU 318	1505		✓					
4	SWMU 318	1550		✓					
5	SWMU 318	1555		✓					
6	SWMU 318	1555		✓					
7	SWMU 318	1600		✓					
8	SWMU 318	1630		✓					
9	SWMU 318	1635		✓					
10	SWMU 318	1640		✓					
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)	
1	1-10	H. M. K. L.		J. M. L.		2/5/05	1730	Add Bill to 05013-100 H. M. K. L.	
2									
3									
4									
Print Name		Sampler's Signature							



02524

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name		Project Location		Analysis Desired (Indicate separate containers)		Due Date	
Project No.		Client/Project Contact		Project Telephone No.		Rush	
Project Fax No.		Project Fax No.		Number of Containers		Standard	
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)	Remarks
1	SWMU 318 GW50	2/10/05	1355		✓		
2	SWMU 318 GW50-01		1415		✓		
3	SWMU 318 GW50-02		1435		✓		
4	SWMU 318 GW46		1110		✓		
5	SWMU 318 GW46-01		1145		✓		
6	SWMU 318 GW46-02		1230		✓		
7	SWMU 318 GW47		910		✓		
8	SWMU 318 GW47-01		930		✓		
9	SWMU 318 GW47-02		1000		✓		
10							
Transfer Number		Item Number		Transfers Relinquished by		Transfers Accepted by	
1		1-9		Jeffrey M. Rodden		Date: 2/15/05	
2							
3							
4							
						Sampler's Signature	
						Print Name	



LANDMARK
LABORATORY & FIELD SERVICES DIVISION

CHAIN-OF-CUSTODY RECORD

02525

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name CTD-0091		Project Location RCRA Camp Lejeune		Project Telephone No.		Project Fax No.		Number of Containers	Analysis Desired (Indicate separate containers)	Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard		
Project No. 104559		Client/Project Contact Baker / Rob Sok										
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)				Remarks		
1	SWMU318-GW49	2/6/05	1510		✓					3	X	OS012-129
2	SWMU318-GW49-01	2/6/05	1530		✓					3	X	121
3	SWMU318-GW49-010	2/6/05	1530		✓					3	X	121
4	SWMU318-GW49-02	2/6/05	1550		✓					3	X	122
5												
6												
7												
8												
9												
10												
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Date	Time	Remarks (Billing information or other instructions - please print)				
1	1-4					02/06/05	16:10					
2												
3								Sampler's Signature				
4								Print Name				



LANDMARK[®] CHAIN-OF-CUSTODY RECORD

LABORATORY & FIELD SERVICES DIVISION

02526

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411									
Project Name		Project Location		WORK ORDER NO.		Analysis Desired (Indicate separate containers)		Remarks	
CTD-0091 Cape Leisance		Client/Project Contact		Project Telephone No.		Number of Containers		Due Date: <input type="checkbox"/> Rush <input type="checkbox"/> Standard	
104559		Baker/Rob Sak		Project Fax No.					
Item No.	Sample Number	Date	Time	Grab	Comp	Sample Description (Include matrix and point of sample)			
1	SWMU 316- 5009-030	9/2/05	0905	✓			1	+	05012-123
2	SWMU 318 61051-01	2/7/05	1610	✓			3	X	124
3	SWMU 316 61051-01		1635	✓			3	X	125
4	SWMU 318 61051-02		1700	✓			3	X	126
5	SWMU 318 5022-00		1335	✓			1	X	127
6	SWMU 316 5022-03		1355	✓			1	X	128
7	SWMU 318 5022-04		1350	✓			1	X	129
8	SWMU 316 5018-00		1040	✓			1	X	130
9	SWMU 318 5018-02		1045	✓			1	X	131
10	SWMU 318 5018-03		1050	✓			1	X	132
Transfer Number	Item Number	Transfers Relinquished by		Transfers Accepted by		Remarks (Billing Information by other instructions - please print)			
1	1					Hand Delivered			
2	2-10					Sampler's Signature 			
3						Printer's Name 			
4									

02527

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411

WORK ORDER NO.

Project Name		Camp		Project Location		Due Date:	
CTO-0091 RCRP		Legionella				<input type="checkbox"/> Rush <input type="checkbox"/> Standard	
Project No.		Client/Project Contact		Project Telephone No.		Analysis Desired (Indicate separate containers)	
104551		Duke/Rob Suk		Project Fax No.		Remarks	
Item No.	Sample Number	Date	Time	G/G	Gab	Number of Containers	
1	SUNW 318 S027-00	2/7/05	1430		<input checked="" type="checkbox"/>	1	x
2	SUNW 318 S027-02		1440		<input checked="" type="checkbox"/>	1	x
3	SUNW 318 S027-03		1445		<input checked="" type="checkbox"/>	1	x
4	SUNW 318 S024-00		1150		<input checked="" type="checkbox"/>	1	x
5	SUNW 318 S024-03		1145		<input checked="" type="checkbox"/>	1	x
6	SUNW 318 S024-05	2/7/05	1155		<input checked="" type="checkbox"/>	1	x
7							
8							
9							
10							
Transfer Number		Item Number	Transfers Relinquished by		Transfers Accepted by	Data	Time
1		1-6	Jeffrey M. Hest		Duke	02/05/2005	1745
2							
3							
4							
Remarks (Billing information or other instructions - please print)							
Hand Collected							
Sampler's Signature Jeffrey M. Hest							
Print Name Jeffrey M. Hest							



LANDMARK
LABORATORY & FIELD SERVICES DIVISION

CHAIN-OF-CUSTODY RECORD

02528

667 W. Main St. • Benton Harbor, MI 49023-1047 • Phone: 616-927-3004 • Fax: 616-927-3411										WORK ORDER NO.											
Project Name CTO-0091 RCKA CAMP LEISURE				Project Location				Number of Containers	Analysis Desired (Indicate separate containers) <i>8260</i>										Due Date:		
Project No.		Client/Project Contact BAKER / Rob Sat				Project Telephone No.													<input type="checkbox"/> Rush		
						Project Fax No.													<input type="checkbox"/> Standard		
Item No.	Sample Number	Date	Time	Comp	Grab	Sample Description (Include matrix and point of sample)				Remarks											
1	SWMU 318- SB25-00	4/8/05	1020		✓					1	✓									05012-139	
2	SWMU 318- SB25-02		1025		✓					1	✓									140	
3	SWMU 318- SB25-04		1030		✓					1	✓									141	
4	SWMU 318- SB28-00		1105		✓					1	✓									142	
5	SWMU 318- SB28-02		1115		✓					1	✓									143	
6	SWMU 318- SB28-04		1120		✓					1	✓									144	
7	SWMU-318 SB16-00D	2/4/05	1155		✓						✓									145	
8	SWMU 318- SB35-01D	2/5/05	1055		✓						✓									146	
9	SWMU 318- SB27-03D	2/7/05	1445		✓						✓									147	
10	SWMU 318- SB28-02D	2/8/05	1115		✓						✓									148	
Transfer Number	Item Number	Transfers Relinquished by				Transfers Accepted by				Date	Time	Remarks (Billing information or other instructions - please print)									
1	1-6	<i>Jeffrey M. Rodriguez</i>				<i>[Signature]</i>				2/28/05	1235										
2	7-10	<i>[Signature]</i>				<i>[Signature]</i>				2/28/05	1235										
3												Sampler's Signature <i>Jeffrey M. Rodriguez</i>									
4												Print Name <i>Jeffrey M. Rodriguez</i>									

Baker

Baker Environmental, Inc.

APPENDIX C

Data Validation Report

e*data, inc.

Environmental Data Management
& Chemistry Consulting Services

August 9, 2005

Adrienne Jones
CH2M HILL, Inc.
5700 Cleveland Ave, Suite 101
Virginia Beach, VA 23462

Subject: Data Validation Report for MCB Camp Lejeune, Jacksonville, North Carolina.
Contract No. N62470-02-D-3052, CTO#0091

Dear Ms. Jones,

Enclosed is the revised data validation package of CTO #0091, MCB Camp Lejeune, Jacksonville, North Carolina samples. A correction to the text describing the type of sampling matrix from sediment and fish tissue to soil and groundwater. This report addresses 6 data packages and EDDs, which included Sample Delivery Group Nos. CTO091-1, CTO091-2, CTO091-3, CTO091-4, CTO091-5, and CTO091-6.

Please call me at (919) 829-3571 if you have any questions or need additional information.

Sincerely,

E-Data, Inc.

Christopher Ohland
Senior Environmental Chemist

Enclosures
CMO/kk

edata:CTO#0091_NARRATIVE_rev2

Data Validation Report
RFIs at SWMU 303/318 and 336
MCB Camp Lejeune
Jacksonville, North Carolina

August 9, 2005

Revision 2

Prepared For CH2MHILL
Navy CLEAN II Prime Contract No.
N62470-02-D-3052, CTO#0091

Prepared by E-Data, Inc.
213 Oberlin Road,
Carriage House
Raleigh, North Carolina 27605

Acronyms and Abbreviations

AA	Atomic Absorption	LCS	Laboratory Control Sample
AOB	Analytical Operations Branch	MDL	Method Detection Limit
APO	Administrative Project Officer	mL	Milliliter
BFB	Bromofluorobenzene	MS	Matrix Spike
BNA	Base-neutral/acid	MSD	Matrix Spike Duplicate
CCB	Continuing Calibration Blank	MSA	Method of Standard Addition
CCV	Continuing Calibration Verification	m/z	the ration of mass (m) to charge (z) of ions measured by GC/MS
CF	Calibration Factor	NFG	Nation Functional Guidelines
CLP	Contract Laboratory Program	PB	Preparation Blank
COC	Chain-of-Custody	PCB	Polychlorinated Biphenyl
CRDL	Contract Required Detection Limit	PEST	Pesticides
CRQL	Contract Required Quantitation Limit	QA	Quality Assurance
CV	Coefficient of Variation	QAPP	Quality Assurance Program Project (or Project) Plan
%D	Percent Difference	QC	Quality Control
DFTPP	Decafluorotriphenylphosphine	%R	Percent Recovery of Spiked Amounts of Analytes
DQO	Data Quality Objective	RIC	Reconstructed Ion Chromatogram
DV	Data Validation	RL	Reporting Limits
DUP	Duplicate	RPD	Relative Percent Difference
ECD	Electron Capture Detector	RRF	Relative Response Factor
EICP	Extracted Ion Current Profile	RSD	Relative Standard Deviation
EPA	Environmental Protection Agency	RT	Retention Time
GC	Gas Chromatography	SDG	Sample Delivery Group
GS/MS	Gas Chromatography/Mass Spectroscopy	SMC	System Monitoring Compound
GPC	Gel Permeation Chromatography	SOW	Scope of Work
ICB	Initial Calibration Blank	SVOC	Semi Volatile Organic Compound
ICP	Inductively Coupled Plasma	TAL	Target Analyte List
ICS	Inter-element Check Sample	TCL	Target Compound List
ICV	Initial Calibration Verification	TIC	Tentatively Identified Compound
IDL	Instrument Detection Limit	VOC	Volatile Organic Compound
IS	Internal Standard		

Overview

The U.S. Department of the Navy issued a task order to conduct sampling and analysis activities at MCB Camp Lejeune, Jacksonville NC under the Navy Clean Prime Contract No. N62470-02-D-3052, CTO#0091. This report describes the validation of analytical data generated under this scope of work. E-Data Inc., located in Raleigh, NC provided the data validation services.

Field teams collected soil and groundwater environmental samples and associated field quality control samples between February 2 and 19, 2005. Environmental samples were taken at 73 unique field locations. A summary of the samples collected is shown in Table 1. Field quality control samples including 7 field duplicate samples, 5 equipment rinse blank, 3 field blank, and 6 trip blank sample were also submitted to the laboratory. The laboratory prepared project-specific samples for matrix spike/matrix spike duplicate (MS/MSD) analyses.

TABLE 1
Sample Cross-Reference Summary
(MCB Camp Lejeune)

Lab ID No.	Field Sample ID No.	Type of Sample	Sampled
WV0505-5	ER01-020205	Eq. Rinse	02/02/05
WV0528-6	ER02-020405	Eq. Rinse	02/04/05
WV0589-1	ER03-020605	Eq. Rinse	02/06/05
WV0589-2	ER04-020805	Eq. Rinse	02/08/05
WV0758-8	ER05-05A	Eq. Rinse	02/20/05
WV0749-1	FB01-05A	Field Blank	02/18/05
WV0749-2	FB02-05A	Field Blank	02/18/05
WV0749-3	FB03-05A	Field Blank	02/18/05
WV0758-7	SWMU318-MW05DW-05AD	Field Dup.	02/20/05
WV0579-1	SWMU318-SB20-00D	Field Dup.	02/08/05
WV0580-1	SWMU318-SB25-02D	Field Dup.	02/08/05
WV0580-3	SWMU318-SB25-04D	Field Dup.	02/08/05
WV0581-3	SWMU318-SB27-02D	Field Dup.	02/07/05
WV0580-5	SWMU318-SB28-02D	Field Dup.	02/08/05
WV0580-7	SWMU318-SB28-04D	Field Dup.	02/08/05
WV0749-17	318-MW01-05A	Normal	02/15/05
WV0749-11	318-MW02-05A	Normal	02/16/05
WV0749-12	318-MW02D-05A	Normal	02/16/05
WV0749-14	318-MW03-05A	Normal	02/16/05
WV0749-7	318-MW04-05A	Normal	02/17/05
WV0749-8	318-MW04D-05A	Normal	02/17/05
WV0749-10	318-MW05-05A	Normal	02/17/05
WV0749-15	86-GW02IW-05A	Normal	02/16/05
WV0749-5	86-GW17IW-05A	Normal	02/17/05
WV0749-16	86-GW20IW-05A	Normal	02/16/05
WV0749-6	86-GW21IW-05A	Normal	02/17/05
WV0749-9	86-GW22IW-05A	Normal	02/17/05
WV0749-13	86-GW27IW-05A	Normal	02/16/05
WV0528-1	SWMU318-GW31	Normal	02/03/05
WV0528-4	SWMU318-GW31	Normal	02/03/05

TABLE 1

Sample Cross-Reference Summary
(MCB Camp Lejeune)

Lab ID No.	Field Sample ID No.	Type of Sample	Sampled
WV0528-3	SWMU318-GW32	Normal	02/03/05
WV0528-5	SWMU318-GW33	Normal	02/04/05
WV0528-2	SWMU318-GW33-01	Normal	02/04/05
WV0505-3	SWMU318-GW34	Normal	02/02/05
WV0578-3	SWMU318-GW35	Normal	02/05/05
WV0578-2	SWMU318-GW35-01	Normal	02/05/05
WV0505-7	SWMU318-GW36	Normal	02/03/05
WV0505-6	SWMU318-GW37	Normal	02/03/05
WV0505-2	SWMU318-GW38	Normal	02/02/05
WV0578-4	SWMU318-GW51-01	Normal	02/07/05
WV0758-5	SWMU318-MW04DW-05A	Normal	02/19/05
WV0758-6	SWMU318-MW05DW-05A	Normal	02/20/05
WV0758-4	SWMU318-MW06-05A	Normal	02/19/05
	SWMU318-MW06DW-05A		
WV0758-3		Normal	02/19/05
WV0758-2	SWMU318-MW07-05A	Normal	02/19/05
WV0758-1	SWMU318-MW08-05A	Normal	02/19/05
WV0580-15	SWMU318-SB14-02	Normal	02/05/05
WV0580-16	SWMU318-SB14-03	Normal	02/05/05
WV0580-13	SWMU318-SB15-01	Normal	02/05/05
WV0580-14	SWMU318-SB15-03	Normal	02/05/05
WV0527-4	SWMU318-SB16-00	Normal	02/04/05
WV0527-5	SWMU318-SB16-02	Normal	02/04/05
WV0580-17	SWMU318-SB17-02	Normal	02/05/05
WV0580-18	SWMU318-SB17-03	Normal	02/05/05
WV0580-8	SWMU318-SB18-01	Normal	02/07/05
WV0580-9	SWMU318-SB18-02	Normal	02/07/05
WV0580-10	SWMU318-SB18-03	Normal	02/07/05
WV0580-11	SWMU318-SB19-00	Normal	02/04/05
WV0580-12	SWMU318-SB19-05	Normal	02/04/05
WV0514-8	SWMU318-SB20-00	Normal	02/03/05
WV0514-9	SWMU318-SB20-02	Normal	02/03/05
WV0514-10	SWMU318-SB20-04	Normal	02/03/05
WV0514-2	SWMU318-SB21-00	Normal	02/03/05
WV0514-3	SWMU318-SB21-02	Normal	02/03/05
WV0514-4	SWMU318-SB21-04	Normal	02/03/05
WV0580-19	SWMU318-SB22-03	Normal	02/07/05
WV0580-20	SWMU318-SB22-04	Normal	02/07/05
WV0514-5	SWMU318-SB23-00	Normal	02/03/05
WV0514-6	SWMU318-SB23-02	Normal	02/03/05
WV0527-1	SWMU318-SB23-02	Normal	02/03/05
WV0514-7	SWMU318-SB23-04	Normal	02/03/05
WV0581-5	SWMU318-SB24-00	Normal	02/07/05

TABLE 1
Sample Cross-Reference Summary
(MCB Camp Lejeune)

Lab ID No.	Field Sample ID No.	Type of Sample	Sampled
WV0581-1	SWMU318-SB24-03	Normal	02/07/05
WV0581-6	SWMU318-SB24-03	Normal	02/07/05
WV0579-2	SWMU318-SB25-02	Normal	02/08/05
WV0580-2	SWMU318-SB25-04	Normal	02/08/05
WV0527-2	SWMU318-SB26-01	Normal	02/04/05
WV0527-3	SWMU318-SB26-02	Normal	02/04/05
WV0581-2	SWMU318-SB27-02	Normal	02/07/05
WV0581-4	SWMU318-SB27-03	Normal	02/07/05
WV0580-4	SWMU318-SB28-02	Normal	02/08/05
WV0580-6	SWMU318-SB28-04	Normal	02/08/05
WV0464-1	SWMU336-GW04-01	Normal	02/01/05
WV0505-4	SWMU336-GW09-01	Normal	02/02/05
WV0455-1	SWMU336-SB01-00	Normal	02/01/05
WV0455-2	SWMU336-SB04-02	Normal	02/01/05
WV0455-3	SWMU336-SB05-02	Normal	02/01/05
WV0514-1	SWMU336-SB09-06	Normal	02/02/05
WV0464-2	TB01-020105	Trip Blank	02/01/05
WV0505-1	TB02-020205	Trip Blank	02/02/05
WV0528-7	TB03-020405	Trip Blank	02/04/05
WV0578-1	TB04-020805	Trip Blank	02/08/05
WV0749-4	TB04-021805	Trip Blank	02/18/05
WV0758-9	TB05-022005	Trip Blank	02/20/05

Samples were delivered to Katahdin Analytical Services located in Westbrook, ME for analytical testing. Katahdin performed analytical tests for this scope of work including trace level volatile organic analyses, semi-volatile, and metals. Wet Chemistry tests including total organic carbon and methane/ethane/ethane were not validated under this scope of work. All analyses were conducted at the Westbrook facility, except the methane/ethane/ethane, which were lower tier subcontracted to Air Toxics Limited in Folsom California.

After laboratory analyses were completed and reviewed, Katahdin assembled hardcopy data packages and electronic data deliverables (EDD), which was delivered to CH2MHILL Inc., office located in Virginia Beach, VA office and forwarded to E-Data. Katahdin provided six data packages and EDDs, which included Sample Delivery Group ID Nos. CTO091-1, CTO091-2, CTO091-3, CTO091-4, CTO091-5, and CTO091-6.

Data validation was conducted as described in the USEPA National Laboratory Functional Guidelines for Organic Data Review and USEPA Region 3 Modifications to the Functional Guidelines. A copy of the project chain-of-custody forms and laboratory reports with data qualifiers applied as a result of data validation are provided in Appendix A. Appendix B contains results of all tentatively identified compounds. Appendix C contains copies of the completed checklists used to document the data validation effort.

Summary of Sample Analyses

Hardcopy Data Packages

Project completeness is calculated at 100 percent (7478 valid results of 7478 total results) of the laboratory data undergoing data validation. No major issues were identified as a result of data validation. Minor issues are described below. Project data qualifiers are added to the laboratory reports. A list of project data qualifiers is shown in Table 2.

TABLE 2
List of Project Qualifiers
(MCB Camp Lejeune)

Qualifier	Description
[none]	The analyte was positively identified.
J	The analyte was positively identified; however, the concentration value is an estimate. Also used if a result was measured at a concentration below the Contract Required Quantification Limit (CRQL) or Contract Required Detection Limit (CRDL).
UJ	The analyte was analyzed for, but not detected; however, the concentration value is an estimate.
U	The analyte was analyzed for, but not detected.

Field samples are qualified for the introduction of contaminants resulting from laboratory and field activities as measured in the laboratory method blank, equipment rinse blank, field blank, and trip blank audit samples. Equipment rinse blank, field blank, and trip blank audit samples are not qualified.

A summary of all qualified results is shown on Table D-1 (Appendix D).

Electronic Data Deliverable

The sample results were verified by comparing the results to the validated laboratory Form 1's. Table E-1 (Appendix E) summarizes the 8047 sample results that were verified.

Major Technical Issues

No major technical issues were identified.

Minor Technical Issues

Volatile Organic Analyses (SDG CTO091-1)

Chain of Custody and Sample Login

No deficiencies noted during the review.

Surrogate Recoveries

All surrogate recoveries were acceptable, except sample WV0514-8. Two of the three surrogates recovered below the lower control limit. A re-analysis and matrix spike duplicate analysis was performed with similar results. The results for this sample are qualified as estimates and flagged "J" if detected and "UJ" if non-detected. The re-analysis is redundant and therefore is qualified as rejected and flagged "R."

Matrix Spike

Matrix spike and matrix spike duplicate analysis was performed on sample WV0514-8. Acceptable accuracy objectives were met.

Laboratory Control Samples

Laboratory control samples were analyzed with acceptable accuracy objectives.

Method and Field Blanks

Trace levels of volatile organics were detected in one or more field, trip, equipment, or laboratory method blank analysis. Action levels were calculated using the 5X and 10X Rule. Sample results less than the calculated action level are qualified as non-detected and flagged "U." The following action levels were applied: Methylene Chloride (130 ug/Kg), 2-hexanone 10), toluene (10), and 1,2,4-trichlorobenzene (5).

Field Duplicate

Field duplicate samples were collected and analyses were performed using field sample pair WV0514 8 and WV0579-1. Sample concentrations are less than the reporting limit. Acceptable field duplicate precision objectives were obtained.

Calibrations

All initial and continuing calibrations were within acceptable control limits, except for acetone and methylene chloride. Sample results for methylene chloride were previously qualified for blank contamination and flagged "U." All acetone results detected at concentrations greater than the reporting limit are qualified as estimated and flagged "J."

Internal Standard Recovery

All internal standard spike recoveries were acceptable.

Reporting Limits

Nominal reporting limits were achieved.

Volatile Organic Analyses (SDG CTO091-2)

Chain of Custody and Sample Login

No deficiencies noted during the review.

Surrogate Recoveries

Surrogate recoveries were within acceptable QC limits.

Matrix Spike

Matrix spike and matrix spike duplicate analysis was performed on sample WV0758-1. Acceptable accuracy and precision objectives were met.

Laboratory Control Samples

Laboratory control samples were analyzed with acceptable accuracy objectives.

Method and Field Blanks

Trace levels of volatile organics were detected in one or more field, trip, equipment, or laboratory method blank analysis. Action levels were calculated using the 5X and 10X Rule. Sample results less than the calculated action level are qualified as non-detected and flagged "U." The following action levels were applied: Methylene Chloride (50 ug/L), toluene (10), and 1,2,4-trichlorobenzene (5).

Field Duplicate

Field duplicate samples were collected and analyses were performed using field sample pair WV0758 6 and WV0758-7. Sample concentrations are less than the reporting limit. Acceptable field duplicate precision objectives were obtained.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Internal Standard Recovery

Internal standard spike recoveries were acceptable.

Reporting Limits

Nominal reporting limits were achieved.

Volatile Organic Analyses (SDG CTO091-5)

Chain of Custody and Sample Login

There are no deficiencies noted during the review.

Surrogate Recoveries

Surrogate recoveries were within acceptable QC limits.

Matrix Spike

A matrix spike and matrix spike duplicate analysis was performed on sample WV0749-6. Acceptable accuracy and precision objectives were met.

Laboratory Control Samples

Laboratory control samples were analyzed with acceptable accuracy objectives.

Method and Field Blanks

Trace levels of volatile organics were detected in one or more field, trip, equipment, or laboratory method blank analysis. Action levels were calculated using the 5X and 10X Rule. Sample results less than the calculated action level are qualified as non-detected and flagged "U." The following action levels were applied: Methylene Chloride (30 ug/L), toluene (10), and 1,2,4-trichlorobenzene (5).

Field Duplicate

Field duplicate samples were not collected and analyses using field samples assigned to the SDG grouping. An assessment of this QC type could not be completed.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Internal Standard Recovery

Internal standard spike recoveries were acceptable.

Reporting Limits

Nominal reporting limits were achieved.

Semivolatile Organic Analyses (SDG CTO091-1)**Sample Holding Times, Preservations, and Receipt**

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits.

Matrix Spike

A matrix spike and matrix spike duplicate analysis was requested with samples assigned to this SDG grouping. Laboratory control samples were assigned to the extraction batches. An assessment of this QC type could not be performed.

Laboratory Control Sample

A laboratory control sample and duplicate analysis was assigned to sample extraction batches that did not contain project specific matrix spike analyses. All laboratory control samples demonstrated acceptable accuracy and precision objectives.

Blanks

Trace levels of di-n-butyl phthalate were measured in one of the method blanks. All equipment blanks were absent target analytes. Action levels were determined based on the 10X Rule. Sample results less than the action level were qualified as non-detected and flagged "U." The following action levels were applied: di-n-butyl phthalate (900 mk/Kg). Note that this compound was not detected in any of the associated field samples.

Field Duplicate

Field duplicate samples were not collected and analyses with samples assigned to this SDG grouping. An assessment of this QC type could not be performed.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Semivolatile Organic Analyses (SDG CTO091-2)**Sample Holding Times, Preservations, and Receipt**

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits except for sample WV0578-3 where one of the eight surrogates exceeds the upper control limit. An analysis using a diluted aliquot was performed with acceptable surrogate recoveries, indicating possible matrix interference. No action was taken to qualify the sample result.

Matrix Spike

Matrix spike and matrix spike duplicate analysis was not requested with samples assigned to this SDG grouping. Laboratory control samples were prepared for the extraction batch. An assessment of this QC type could not be performed.

Laboratory Control Spike

Laboratory control sample and duplicate analysis were performed with the two separate extraction batches. Acceptable accuracy and precision objectives were met, except the 4-nitrophenol recoveries associated with field sample WV0578-3. These recoveries were greater than the upper control limit. Sample WV0578-3 does not contain 4-nitrophenol.

Blanks

Laboratory method and equipment blanks were absent target analytes.

Field Duplicate

Field duplicate samples were not collected and analyses with samples assigned to this SDG group. An assessment of this QC type could not be performed.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples, except 2,4-dimethylphenol which is detected above the reporting limit in samples WV0505-6, WV0578-3, and WV0578-3DL. The sample result for WV0578-3 exceeds the calibration range and is not reported. The results for WV0505-6 and WV0578-3DL are qualified as estimated and flagged "J."

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Semivolatile Organic Analyses (SDG CTO091-3)**Sample Holding Times, Preservations, and Receipt**

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits.

Matrix Spike

Matrix spike and matrix spike duplicate analysis was performed using samples WV0580-2 and WV0580-6. Accuracy and precision objectives were met except for pentachlorophenol and 2,4-dinitrotoluene, which were recovered above the upper control limit in one or more analyses. These compounds were not detected in the associated field samples and no action was taken to qualify the sample results.

Blanks

Trace levels of di-n-butyl phthalate were measured in one of the method blanks. All equipment blanks were absent target analytes. Action levels were determined based on the 10X Rule. Sample results less than the action level were qualified as non-detected and flagged "U." The following action levels were applied: di-n-butyl phthalate (900 mk/Kg). Note that this compound was not detected in any of the associated field samples.

Field Duplicate

Field duplicate samples were collected and analyzed using field sample pairs WV0580-1 & WV0579-2; WV0580-2 & WV0580-3; WV0580-4 & WV0580-5; and WV0580-6 & WV0580-7. All analyses were absent target analytes. Precision objectives were met and no qualification of the data was required.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Semivolatile Organic Analyses (SDG CTO091-4)

Sample Holding Times, Preservations, and Receipt

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits.

Matrix Spike

Matrix spike and matrix spike duplicate analysis was requested with samples assigned to this SDG grouping. An assessment of this QC type could not be performed.

Laboratory Control Sample

Laboratory control sample analysis was assigned to the extraction batch containing work orders WV0580 and WV0581. Acceptable accuracy objectives were reported.

Blanks

Laboratory method and equipment blanks were absent target analytes.

Field Duplicate

Field duplicate samples were collected and analyzed using field sample pairs WV0581-2 & WV0581-3. The analyses were absent target analytes. Precision objectives were met and no qualification of the data was required.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Semivolatile Organic Analyses (SDG CTO091-5)

Sample Holding Times, Preservations, and Receipt

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits.

Matrix Spike

A matrix spike and matrix spike duplicate analysis was performed using field sample WV0749-6. Laboratory control samples were also prepared with this extraction batch. Recoveries for pentachlorophenol and 4-nitrophenol were greater than the upper control limit. Similar results were observed with the laboratory control sample. Calibration deficiencies were also noted which may be the source of the measurement error. No action was taken to qualify the non-detected results.

Laboratory Control Spike

Laboratory control sample and duplicate analysis were performed with the two separate extraction batches. Acceptable accuracy and precision objectives were met, except the 4-nitrophenol recoveries associated with field sample WV0589-1 and WV0589-2 and pentachlorophenol recoveries associated with work order WV0749. These recoveries were greater than the upper control limit. Neither compound was detected in any of the associated field sample. No action was taken to qualify the sample results.

Blanks

Laboratory method and equipment blanks were absent target analytes.

Field Duplicate

Field duplicate samples were not collected and analyses with samples assigned to this SDG grouping. An assessment of this QC type could not be performed.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples.

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Semivolatile Organic Analyses (SDG CTO091-6)**Sample Holding Times, Preservations, and Receipt**

No deficiencies were noted during the review.

Surrogate Recovery

Surrogate recoveries are within the acceptable control limits.

Matrix Spike

Matrix spike and matrix spike duplicate analysis was performed using field sample WV0758-1. Laboratory control samples were also prepared with this extraction batch. Recoveries for pentachlorophenol and 4-nitrophenol were greater than the upper control limit. Similar results were observed with the laboratory control sample. Calibration deficiencies were also noted which may be the source of the measurement error. No action was taken to qualify the non-detected results.

Laboratory Control Spike

Laboratory control sample and duplicate analysis were performed with the two separate extraction batches. Acceptable accuracy and precision objectives were met, except the 4-nitrophenol and pentachlorophenol recoveries associated with work order WV0758. These recoveries were greater than the upper control limit. Neither compound was detected in any of the associated field sample. No action was taken to qualify the sample results.

Blanks

Laboratory method and equipment blanks were absent target analytes.

Field Duplicate

Field duplicate samples were collected and analyses with field pair samples WV0758-6 and WV0758-7. The field duplicate pairs were absent of target analytes. Field precision objectives were achieved.

Calibrations

Minor calibration deficiencies were observed for compounds that were not detected in the associated field samples. No action was taken to qualify the sample results.

Quantifications

Manual quantifications were performed on one or more of the process files associated with this SDG.

Internal Standards

Internal standard areas were within acceptable QC limits.

Reporting Limits

Nominal reporting limits were achieved for all samples.

Metal Analyses (SDG CTO091-1)**Sample Receipt and Preservation**

Samples were received intact and in good condition, except Sample WV0581-3 was not listed on the Chain of Custody form received from the field. The laboratory was instructed to perform the metals analyses.

Calibrations

Calibrations were within acceptable limits for the reported measurements.

Trace Level Checks

Trace level check recovered within acceptable QC limit. Note that barium is not included in the check solutions.

Blank Contaminants

Trace levels of metals were present in one or more instrument initial calibration blank, continuing calibration blank, preparation blank, and field QC blank analyses. Action levels were determined based on the 5X rule. Sample results less than the action levels are qualified as non-detected and flagged "U." The following action levels were applied (mg/Kg): As (90), Ba (1.1), Cd (0.62), Cr (3.2), Pb (3.0), Hg (0.13), Se (8.4), and Ag (4.8).

ICP Interference Check Sample

Interference check samples were analyzed within acceptable control limits.

Laboratory Control Sample

Laboratory control samples were analyzed within acceptable control limits, except a single run for mercury. The laboratory control sample for mercury was analyzed at the beginning and through out the analytical sequence. The initial analysis exceeds the upper control limit while the remaining are acceptable. Biases resulting from mercury blank measurements are greater

than the laboratory control sample error and no action was taken to qualify the data. See discussion on blank contaminants.

Field Duplicate

A field duplicate sample was collected and analyzed with field sample pair WV0581-2 and WV0581-3. Acceptable field precision objectives were achieved.

Matrix Spike and Laboratory Duplicates

Matrix spike and laboratory duplicate samples were collected and analyzed using samples WV0514-1 and WV0581-2. Acceptable project accuracy and precision objectives were met, except the arsenic result for sample WV0581-2. For sample WV0581-2, arsenic was fortified at concentrations less than four times the native concentrations and the recovery data is inconclusive. No action was taken to qualify sample WV0581-2 results.

Serial Dilutions

Serial dilution analyses were performed using field sample WV0514-1 and WV0581-2. Acceptable results were obtained for all analyses, except the selenium result for sample WV0581-2. This result was previously qualified as non-detected and flagged "U."

Metal Analyses (SDG CTO091-2)

Sample Receipt and Preservation

Samples were received intact and in good condition.

Calibrations

Calibrations were within acceptable limits for the reported measurements.

Trace Level Checks

Trace level check recovered within acceptable QC limit, except marginal excursions for selenium and lead. Note that barium is not included in the check solutions. No action was taken to qualify the sample results for low level recovery checks.

Blank Contaminants

Trace levels of metals were present in one or more instrument initial calibration blank, continuing calibration blank, preparation blank, and field QC blank analyses. Action levels were determined based on the 5X rule. Sample results less than the action levels are qualified as non-detected and flagged "U." The following action levels were applied (mg/L): As (24.5), Ba (5.5), Cd (3.1), Cr (16), Pb (15), Hg (0.25), Se (42), and Ag (24).

ICP Interference Check Sample

Interference check samples were analyzed within acceptable control limits.

Laboratory Control Sample

Laboratory control samples were analyzed within acceptable control limits, except a single mercury analysis affecting samples included in SDG grouping CTO091-6. The associated mercury measurements have been previously qualified for blank contaminants. No additional action is needed to qualify the sample results.

Field Duplicate

Field duplicate sample were not collected field sample assigned to this SDG group. An assessment of this QC type could not be completed.

Matrix Spike and Laboratory Duplicates

Matrix spike and laboratory duplicate samples were collected and analyzed using field samples WV0749 6, WV0749-12 (Hg only) and WV0758-1. Acceptable project precision objectives were met but not all accuracy objectives were achieved. For sample WV0758 1, the recovery of mercury and selenium lay above the upper control limit. No action was taken to qualify the non-detected results.

Serial Dilutions

Serial dilution analyses were performed using field sample WV0749-6 and WV0758-1. Acceptable results were obtained for all analyses.

Metal Analyses (SDG CTO091-3)**Sample Receipt and Preservation**

Samples were received intact and in good condition.

Calibrations

Calibrations were within acceptable limits for the reported measurements.

Trace Level Checks

Trace level check recovered within acceptable QC limit. Note that barium is not included in the check solutions.

Blank Contaminants

Trace levels of metals were present in one or more instrument initial calibration blank, continuing calibration blank, preparation blank, and field QC blank analyses. Action levels were determined based on the 5X rule. Sample results less than the action levels are qualified as non-detected and flagged "U." The following action levels were applied (mg/Kg): As (4.9), Ba (1.1), Cd (0.83), Pb (3.8), Hg (0.13), Se (4.5), and Ag (1.1).

ICP Interference Check Sample

Interference check samples were analyzed within acceptable control limits.

Laboratory Control Sample

Laboratory control samples were analyzed within acceptable control limits.

Field Duplicate

Field duplicate sample was collected and analyzed with field sample pairs WV0579-2 & WV0580-1, WV0580-2 & WV0580-3, WV0580-4 & WV0580-5, and WV0580-6 & WV0580-7. Acceptable field precision objectives were achieved.

Matrix Spike and Laboratory Duplicates

Matrix spike and laboratory duplicate samples were collected and analyzed using field samples WV0580 2 and WV0580 6. Acceptable project precision objectives were met but not all accuracy objectives were achieved. For sample WV0580 2, the recovery of arsenic and selenium fall below the lower control limit. Both parameters were fortified at concentrations less than four times the native concentrations and the recovery data is inconclusive. No action was taken to qualify sample WV0580-2 results. For sample WV0580 6, the recovery of arsenic, chromium, lead, and selenium fall outside the established control limits. Again, these parameters were fortified at concentrations less than four times the native concentrations and the recovery data is inconclusive. No action was taken to qualify sample WV0580-6 results.

Serial Dilutions

Serial dilution analyses were performed using field sample WV0580-2 and WV0580-6. Acceptable results were obtained for all analyses.

Baker

Baker Environmental, Inc.

APPENDIX D

Summary of Analytical Results

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RPT GROUNDWATER
RCRA FACILITY INVESTIGATION (CFO-0091)
MCB, CAMP LEBERNE, NORTH CAROLINA
SWMU336

Sample ID	Sample Date	SWMU336-GW01	SWMU336-GW01-01	SWMU336-GW04	SWMU336-GW04-01	SWMU336-GW05	SWMU336-GW05-01	SWMU336-GW08	SWMU336-GW08-01	SWMU336-GW08-01D	SWMU336-GW09	SWMU336-GW09-01
Volatile Organic Compounds (ug/L)												
1,1,1,2-Tetrachloroethane	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,1-Trichloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2,2-Tetrachloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,3-Trichloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichloropropene	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	0.73 U	5 U	5 U	5 U	5 U
1,2,3-Trichloropropene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	0.66 U	5 U	5 U	5 U	5 U
1,2,4-Trimethylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromochloroethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromochloroethane	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,2-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Chlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
4-Chlorobenzene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Benzene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromochlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichlorobenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromoforn	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dibromomethane	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylcyclohexane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
n-Butylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Propylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
p-Xylene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
p-Xenyltoluene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
sec-Butylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Styrene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butylbenzene	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,3-Dichloropropene	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethane	2/1/2005	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	2/1/2005	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl chloride	2/1/2005	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI GROUNDWATER
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-GW10	SWMU336-GW10-01	SWMU336-GW10D
Sample Date	2/4/2005	2/4/2005	2/4/2005
Volatile Organic Compounds (ug/L)			
1,1,1,2-Tetrachloroethane	2 U	2 U	2 U
1,1,1-Trichloroethane	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U
1,1,2-Trichloroethane	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U
1,1-Dichloropropene	1 U	1 U	1 U
1,2,3-Trichlorobenzene	5 U	5 U	5 U
1,2,3-Trichloropropene	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U
1,2,4-Trimethylbenzene	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	5 U	5 U	5 U
1,2-Dibromoethane	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U
1,2-Dichloroethane	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U
1,3,5-Trimethylbenzene	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U
1,3-Dichloropropane	1 U	1 U	1 U
1,4-Dichlorobenzene	2 U	2 U	2 U
2,2-Dichloropropane	1 U	1 U	1 U
2-Chlorotoluene	2 U	2 U	2 U
4-Chlorotoluene	2 U	2 U	2 U
Benzene	1 U	1 U	1 U
Bromobenzene	2 U	2 U	2 U
Bromochloromethane	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U
Bromomethane	5 U	5 U	5 U
Carbon tetrachloride	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U
Chloroethane	5 U	5 U	5 U
Chloroform	1 U	1 U	1 U
Chloromethane	5 U	5 U	5 U
cis-1,2-Dichloroethene	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U
Dibromochloromethane	2 U	2 U	2 U
Dibromomethane	2 U	2 U	2 U
Dichlorodifluoromethane	5 U	4.3 J	5 U
Ethylbenzene	1 U	1 U	1 U
Hexachlorobutadiene	5 U	5 U	5 U
Isopropylbenzene	2 U	2 U	2 U
Methylene chloride	5 U	5 U	5 U
Naphthalene	3.2 J	5 U	5 U
n-Butylbenzene	2 U	2 U	2 U
n-Propylbenzene	2 U	2 U	2 U
o-Xylene	1 U	1 U	1 U
p&m-Xylene	2 U	2 U	2 U
p-Isopropyltoluene	2 U	2 U	2 U
sec-Butylbenzene	2 U	2 U	2 U
Styrene	1 U	1 U	1 U
tert-Butylbenzene	2 U	2 U	2 U
Tetrachloroethene	1 U	1 U	1 U
Toluene	1 U	1 U	1 U
trans-1,2-Dichloroethene	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U
Trichlorofluoromethane	5 U	5 U	5 U
Vinyl chloride	2 U	2 U	2 U

Appendix D
QA/QC Results Summary - SWMU 336
RCRA Facility Investigation (CTO-0091)
MCB, Camp Lejeune, North Carolina

Sample ID	ER01-020205	ER02-020405	FB01-021805	FB02-021805	FB03-021805	TB01-020105	TB02-020205	TB03-020405
Sample Date	2/2/05	2/4/05	2/18/05	2/18/05	2/18/05	2/1/05	2/2/05	2/4/05
Volatile Organic Compounds (ug/L)								
Bromodichloromethane	10 U	10 U	10 U	10 U	29	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	77	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	14	10 U	10 U	10 U
Methylene chloride	10 U	10 U	10 U	10 U	10 U	2 J	2 J	1 J
Toluene	1 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (ug/L)								
Arsenic	NA	3.03 U	3.03 U	3.03 U	4.9 J	NA	NA	NA
Barium	NA	0.17 U	0.17 U	0.17 U	1.1 J	NA	NA	NA
Cadmium	NA	0.46 J	0.3 U	0.3 U	0.3 U	NA	NA	NA
Mercury	NA	0.03 J	0.04 J	0.05 J	0.04 J	NA	NA	NA
Selenium	NA	3.71 U	3.71 U	3.71 U	4.5 J	NA	NA	NA
Silver	NA	0.7 U	0.7 U	0.7 U	0.93 J	NA	NA	NA

Notes:

U - Non-detected chemical.

J - Estimated Value.

NA - Not Analyzed.

ug/L - micrograms per liter

**APPENDIX D
MOBILE LABORATORY ANALYTICAL RESULTS - RET SUBSURFACE SOILS**

**RCRA FACILITY INVESTIGATION (CFO-4091)
MCB, CAMP LEBELINE, NORTH CAROLINA**

Sample ID	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02	SWMU336-SB05-03	SWMU336-SB09-03	SWMU336-SB09-03D	SWMU336-SB09-06
Sample Date	1-Feb-05	1-Feb-05	1-Feb-05	1-Feb-05	1-Feb-05	1-Feb-05	1-Feb-05	2-Feb-05	2-Feb-05	2-Feb-05
Sample Depth (ft)	3-5	7-9	3-5	7-9	1-3	3-5	11-13	5-7	5-7	13-15
Volatile Organic Compounds (ug/kg)										
1,1,1,2-Tetrachloroethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,1,1-Trichloroethane	1.22 U	1.22 U	2.33 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,1,2,2-Tetrachloroethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,1,2-Trichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,1-Dichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,1-Dichloroethene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,1-Dichloropropene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,2,3-Trichlorobenzene	6.11 U	6.11 U	0.65 J	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
1,2,3-Trichloropropene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,2,4-Trichlorobenzene	6.11 U	6.11 U	0.67 J	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
1,2,4-Trimethylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	170.00	1.70 J	2.56 U	2.37 U	2.33 U	2.27 U
1,2-Dibromo-3-chloropropene	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
1,2-Dibromomethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,2-Dichlorobenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,2-Dichloroethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,2-Dichloropropene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
1,3,5-Trimethylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	130.00	1.10 J	2.56 U	2.37 U	2.33 U	2.27 U
1,3-Dichlorobenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
1,4-Dichlorobenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
2,2-Dichloropropene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
2-Chlorotoluene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
4-Chlorotoluene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Benzene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Bromobenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Bromochloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Bromodichloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Bromoforn	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Bromomethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Carbon tetrachloride	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Chlorobenzene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Chloroethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Chloroform	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Chloromethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
cis-1,2-Dichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
cis-1,3-Dichloropropene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Dibromochloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Dibromomethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Dichlorodifluoromethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Ethylbenzene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Hexachlorobutadiene	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Isopropylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Methylbenzene	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Naphthalene	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
n-Butylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
n-Propylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
o-Xylene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
p-Xylene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
p-Isopropylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
sec-Butylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Styrene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
tert-Butylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U
Tetramethylethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Toluene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
trans-1,2-Dichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
trans-1,3-Dichloropropene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Trichloroethene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.18 U	1.17 U	1.13 U
Trichloromethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.36 U	6.41 U	5.92 U	5.83 U	5.67 U
Vinyl chloride	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.37 U	2.33 U	2.27 U

APPENDIX D
MOBILE LABORATORY DETECTIONS SUMMARY - RFI SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)			
1,1,1,2-Tetrachloroethane	2 U	2 U	2 U
1,1,1-Trichloroethane	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U
1,1,2-Trichloroethane	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U
1,1-Dichloroethene	1 U	1 U	1 U
1,1-Dichloropropene	1 U	1 U	1 U
1,2,3-Trichlorobenzene	0.87 J	5 U	6 U
1,2,3-Trichloropropane	2 U	2 U	2 U
1,2,4-Trichlorobenzene	0.77 J	5 U	6 U
1,2,4-Trimethylbenzene	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane	6 U	5 U	6 U
1,2-Dibromoethane	2 U	2 U	2 U
1,2-Dichlorobenzene	2 U	2 U	2 U
1,2-Dichloroethane	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U
1,3,5-Trimethylbenzene	2 U	2 U	2 U
1,3-Dichlorobenzene	2 U	2 U	2 U
1,3-Dichloropropane	1 U	1 U	1 U
1,4-Dichlorobenzene	2 U	2 U	2 U
2,2-Dichloropropane	1 U	1 U	1 U
2-Chlorotoluene	2 U	2 U	2 U
4-Chlorotoluene	2 U	2 U	2 U
Benzene	1 U	1 U	1 U
Bromobenzene	2 U	2 U	2 U
Bromochloromethane	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U
Bromomethane	6 U	5 U	4.5 J
Carbon tetrachloride	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U
Chloroethane	6 U	5 U	6 U
Chloroform	1 U	1 U	1 U
Chloromethane	6 U	5 U	2.2 J
cis-1,2-Dichloroethene	1 U	1 U	1 U
cis-1,3-Dichloropropene	1 U	1 U	1 U
Dibromochloromethane	2 U	2 U	2 U
Dibromomethane	2 U	2 U	2 U
Dichlorodifluoromethane	6 U	5 U	6 U
Ethylbenzene	1 U	1 U	1 U
Hexachlorobutadiene	6 U	5 U	6 U
Isopropylbenzene	2 U	2 U	2 U
Methylene chloride	6 U	5 U	6 U
Naphthalene	1.1 J	5 U	6 U
n-Butylbenzene	2 U	2 U	2 U
n-Propylbenzene	2 U	2 U	2 U
o-Xylene	1 U	1 U	1 U
p&m-Xylene	2 U	2 U	2 U
p-Isopropyltoluene	2 U	2 U	2 U
sec-Butylbenzene	2 U	2 U	2 U
Styrene	1 U	1 U	1 U
tert-Butylbenzene	2 U	2 U	2 U

APPENDIX D
MOBILE LABORATORY DETECTIONS SUMMARY - RFI SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	0-1	0-1	0-1
Tetrachloroethene	1 U	1 U	1 U
Volatile Organic Compounds (ug/kg)			
Toluene	1 U	1 U	1 U
trans-1,2-Dichloroethene	1 U	1 U	1 U
trans-1,3-Dichloropropene	1 U	1 U	1 U
Trichloroethene	1 U	1 U	1 U
Trichlorofluoromethane	6 U	5 U	6 U
Vinyl chloride	2 U	2 U	2 U

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SUBSURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	3-5	3-5	11-13

Volatile Organic Compounds (ug/kg)

1,1,1-TRICHLOROETHANE	11 U	NA	NA
1,1,2,2-TETRACHLOROETHANE	11 U	NA	NA
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	11 U	NA	NA
1,1,2-TRICHLOROETHANE	11 U	NA	NA
1,1-DICHLOROETHANE	11 U	NA	NA
1,1-DICHLOROETHENE	11 U	NA	NA
1,2,4-TRICHLOROBENZENE	11 U	NA	NA
1,2-DIBROMO-3-CHLOROPROPANE	11 U	NA	NA
1,2-DIBROMOETHANE	11 U	NA	NA
1,2-DICHLOROBENZENE	11 U	NA	NA
1,2-DICHLOROETHANE	11 U	NA	NA
1,2-DICHLOROETHYLENE	11 U	NA	NA
1,2-DICHLOROPROPANE	11 U	NA	NA
1,3-DICHLOROBENZENE	11 U	NA	NA
1,4-DICHLOROBENZENE	11 U	NA	NA
2-BUTANONE	4 J	NA	NA
2-HEXANONE	11 U	NA	NA
4-METHYL-2-PENTANONE	3 J	NA	NA
ACETONE	31	NA	NA
BENZENE	11 U	NA	NA
BROMODICHLOROMETHANE	11 U	NA	NA
BROMOFORM	11 U	NA	NA
BROMOMETHANE	11 U	NA	NA
CARBON DISULFIDE	1 J	NA	NA
CARBON TETRACHLORIDE	11 U	NA	NA
CHLOROBENZENE	11 U	NA	NA
CHLOROETHANE	11 U	NA	NA
CHLOROFORM	11 U	NA	NA

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SUBSURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	3-5	3-5	11-13
Volatile Organic Compounds (ug/kg)			
CHLOROMETHANE	11 U	NA	NA
CIS-1,2-DICHLOROETHENE	11 U	NA	NA
CIS-1,3-DICHLOROPROPENE	11 U	NA	NA
CYCLOHEXANE	11 U	NA	NA
DIBROMOCHLOROMETHANE	11 U	NA	NA
DICHLORODIFLUOROMETHANE	11 U	NA	NA
ETHYLBENZENE	11 U	NA	NA
ISOPROPYLBENZENE	11 U	NA	NA
m- and p-Xylenes	11 U	NA	NA
METHYL ACETATE	15	NA	NA
METHYLCYCLOHEXANE	11 U	NA	NA
METHYLENE CHLORIDE	20 U	NA	NA
METHYL-TERT-BUTYL ETHER(MTBE)	11 U	NA	NA
O-XYLENE	11 U	NA	NA
STYRENE	11 U	NA	NA
TETRACHLOROETHENE	11 U	NA	NA
TOLUENE	11 U	NA	NA
TRANS-1,2-DICHLOROETHENE	11 U	NA	NA
TRANS-1,3-DICHLOROPROPENE	11 U	NA	NA
TRICHLOROETHENE	11 U	NA	NA
TRICHLOROFLUOROMETHANE	2 J	NA	NA
VINYL CHLORIDE	11 U	NA	NA
XYLENES (TOTAL)	11 U	NA	NA
1,1'-BIPHENYL	NA	NA	NA
2,2'-OXYBIS(1-CHLOROPROPANE)	NA	NA	NA
2,4,5-TRICHLOROPHENOL	NA	NA	NA
2,4,6-TRICHLOROPHENOL	NA	NA	NA
2,4-DICHLOROPHENOL	NA	NA	NA

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SUBSURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	3-5	3-5	11-13
Semivolatile Organic Compounds (ug/kg)			
2,4-DIMETHYLPHENOL	NA	NA	NA
2,4-DINITROPHENOL	NA	NA	NA
2,4-DINITROTOLUENE	NA	NA	NA
2,6-DINITROTOLUENE	NA	NA	NA
2-CHLORONAPHTHALENE	NA	NA	NA
2-CHLOROPHENOL	NA	NA	NA
2-METHYLNAPHTHALENE	NA	NA	NA
2-METHYLPHENOL	NA	NA	NA
2-NITROANILINE	NA	NA	NA
2-NITROPHENOL	NA	NA	NA
3,3'-DICHLOROBENZIDINE	NA	NA	NA
3-NITROANILINE	NA	NA	NA
4,6-DINITRO-2-METHYLPHENOL	NA	NA	NA
4-BROMOPHENYL PHENYL ETHER	NA	NA	NA
4-CHLORO-3-METHYLPHENOL	NA	NA	NA
4-CHLOROANILINE	NA	NA	NA
4-CHLOROPHENYL PHENYL ETHER	NA	NA	NA
4-METHYLPHENOL	NA	NA	NA
4-NITROANILINE	NA	NA	NA
4-NITROPHENOL	NA	NA	NA
ACENAPHTHENE	NA	NA	NA
ACENAPHTHYLENE	NA	NA	NA
ACETOPHENONE	NA	NA	NA
ANTHRACENE	NA	NA	NA
ATRAZINE	NA	NA	NA
BENZALDEHYDE	NA	NA	NA
BENZO(A)ANTHRACENE	NA	NA	NA
BENZO(A)PYRENE	NA	NA	NA

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SUBSURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	3-5	3-5	11-13
Semivolatile Organic Compounds (ug/kg)			
BENZO(B)FLUORANTHENE	NA	NA	NA
BENZO(K)FLUORANTHENE	NA	NA	NA
BENZO[G,H,I]PERYLENE	NA	NA	NA
BIS(2-CHLOROETHOXY) METHANE	NA	NA	NA
BIS(2-CHLOROETHYL) ETHER	NA	NA	NA
BIS(2-ETHYLHEXYL) PHTHALATE	NA	NA	NA
BUTYL BENZYL PHTHALATE	NA	NA	NA
CAPROLACTAM	NA	NA	NA
CARBAZOLE	NA	NA	NA
CHRYSENE	NA	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA	NA
DIBENZOFURAN	NA	NA	NA
DIETHYL PHTHALATE	NA	NA	NA
DIMETHYL PHTHALATE	NA	NA	NA
DI-N-BUTYL PHTHALATE	NA	NA	NA
DI-N-OCTYLPHTHALATE	NA	NA	NA
FLUORANTHENE	NA	NA	NA
FLUORENE	NA	NA	NA
HEXACHLOROBENZENE	NA	NA	NA
HEXACHLOROBUTADIENE	NA	NA	NA
HEXACHLOROCYCLOPENTADIENE	NA	NA	NA
HEXACHLOROETHANE	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	NA	NA	NA
ISOPHORONE	NA	NA	NA
NAPHTHALENE	NA	NA	NA
NITROBENZENE	NA	NA	NA
N-NITROSO-DI-N-PROPYLAMINE	NA	NA	NA
N-NITROSODIPHENYLAMINE	NA	NA	NA

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SUBSURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	2/1/05	2/1/05	2/2/05
Sample Depth (ft)	3-5	3-5	11-13
Semivolatile Organic Compounds (ug/kg)			
PENTACHLOROPHENOL	NA	NA	NA
PHENANTHRENE	NA	NA	NA
PHENOL	NA	NA	NA
PYRENE	NA	NA	NA
Total Metals (mg/kg)			
ARSENIC	1.2 U	1.1 U	0.86 U
BARIUM	17.7 J	16.2 J	9.5 J
CADMIUM	0.06 U	0.06 U	0.07 U
CHROMIUM	16.3	19.8	6.2
LEAD	10	9.4	6.1
MERCURY	0.04 U	0.04 U	0.04 U
SELENIUM	0.8 U	0.77 U	0.61 U
SILVER	0.15 U	0.15 U	0.12 U

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB01-00
Sample Date	2/1/05
Chemical Name	

Volatile Organic Compounds (ug/Kg)	
1,1,1-TRICHLOROETHANE	10 U
1,1,2,2-TETRACHLOROETHANE	10 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	10 U
1,1,2-TRICHLOROETHANE	10 U
1,1-DICHLOROETHANE	10 U
1,1-DICHLOROETHENE	10 U
1,2,4-TRICHLOROBENZENE	10 U
1,2-DIBROMO-3-CHLOROPROPANE	10 U
1,2-DIBROMOETHANE	10 U
1,2-DICHLOROBENZENE	10 U
1,2-DICHLOROETHANE	10 U
1,2-DICHLOROETHYLENE	10 U
1,2-DICHLOROPROPANE	10 U
1,3-DICHLOROBENZENE	10 U
1,4-DICHLOROBENZENE	10 U
2-BUTANONE	10 U
2-HEXANONE	10 U
4-METHYL-2-PENTANONE	10 U
ACETONE	8 J
BENZENE	10 U
BROMODICHLOROMETHANE	10 U
BROMOFORM	10 U
BROMOMETHANE	10 U
CARBON DISULFIDE	10 U
CARBON TETRACHLORIDE	10 U
CHLOROBENZENE	10 U
CHLOROETHANE	10 U
CHLOROFORM	10 U
CHLOROMETHANE	10 U
CIS-1,2-DICHLOROETHENE	10 U
CIS-1,3-DICHLOROPROPENE	10 U
CYCLOHEXANE	10 U
DIBROMOCHLOROMETHANE	10 U
DICHLORODIFLUOROMETHANE	10 U
ETHYLBENZENE	10 U
ISOPROPYLBENZENE	10 U
m- and p-Xylenes	10 U
METHYL ACETATE	10 U
METHYLCYCLOHEXANE	10 U
METHYLENE CHLORIDE	12 U
METHYL-TERT-BUTYL ETHER(MTBE)	10 U
O-XYLENE	10 U
STYRENE	10 U
TETRACHLOROETHIENE	10 U
TOLUENE	10 U
TRANS-1,2-DICHLOROETHENE	10 U
TRANS-1,3-DICHLOROPROPENE	10 U
TRICHLOROETHENE	10 U
TRICHLOROFLUOROMETHANE	1 J
VINYL CHLORIDE	10 U
XYLENES (TOTAL)	10 U

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID SWMU336-SB01-00
Sample Date 2/1/05
Chemical Name

Semivolatile Organic Compounds (ug/kg)

1,1'-BIPHENYL	NA
2,2'-OXYBIS(1-CHLOROPROPANE)	NA
2,4,5-TRICHLOROPHENOL	NA
2,4,6-TRICHLOROPHENOL	NA
2,4-DICHLOROPHENOL	NA
2,4-DIMETHYLPHENOL	NA
2,4-DINITROPHENOL	NA
2,4-DINITROTOLUENE	NA
2,6-DINITROTOLUENE	NA
2-CHLORONAPHTHALENE	NA
2-CHLOROPHENOL	NA
2-METHYLNAPHTHALENE	NA
2-METHYLPHENOL	NA
2-NITROANILINE	NA
2-NITROPHENOL	NA
3,3'-DICHLOOROBENZIDINE	NA
3-NITROANILINE	NA
4,6-DINITRO-2-METHYLPHENOL	NA
4-BROMOPHENYL PHENYL ETHER	NA
4-CHLORO-3-METHYLPHENOL	NA
4-CHLOROANILINE	NA
4-CHLOROPHENYL PHENYL ETHER	NA
4-METHYLPHENOL	NA
4-NITROANILINE	NA
4-NITROPHENOL	NA
ACENAPHTHENE	NA
ACENAPHTHYLENE	NA
ACETOPHENONE	NA
ANTHRACENE	NA
ATRAZINE	NA
BENZALDEHYDE	NA
BENZO(A)ANTHRACENE	NA
BENZO(A)PYRENE	NA
BENZO(B)FLUORANTHENE	NA
BENZO(K)FLUORANTHENE	NA
BENZO[G,H,I]PERYLENE	NA
BIS(2-CHLOROETHOXY) METHANE	NA
BIS(2-CHLOROETHYL) ETHER	NA
BIS(2-ETHYLHEXYL) PHTHALATE	NA
BUTYL BENZYL PHTHALATE	NA
CAPROLACTAM	NA
CARBAZOLE	NA
CHRYSENE	NA
DIBENZ(A,H)ANTHRACENE	NA
DIBENZOFURAN	NA
DIETHYL PHTHALATE	NA
DIMETHYL PHTHALATE	NA
DI-N-BUTYL PHTHALATE	NA
DI-N-OCTYLPHTHALATE	NA
FLUORANTHENE	NA
FLUORENE	NA

APPENDIX D
FIXED BASE LABORATORY ANALYTICAL RESULTS - RFI SURFACE SOIL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-SB01-00
Sample Date	2/1/05
Chemical Name	

Semivolatile Organic Compounds (ug/kg)	
HEXACHLOROBENZENE	NA
HEXACHLOROBUTADIENE	NA
HEXACHLOROCYCLOPENTADIENE	NA
HEXACHLOROETHANE	NA
INDENO(1,2,3-CD)PYRENE	NA
ISOPHORONE	NA
NAPHTHALENE	NA
NITROBENZENE	NA
N-NITROSO-DI-N-PROPYLAMINE	NA
N-NITROSODIPHENYLAMINE	NA
PENTACHLOROPHENOL	NA
PHENANTHRENE	NA
PHENOL	NA
PYRENE	NA
Total Metals (mg/Kg)	
ARSENIC	1 U
BARIUM	10.4 J
CADMIUM	0.05 U
CHROMIUM	10.8
LEAD	6
MERCURY	0.07 U
SELENIUM	0.62 U
SILVER	0.12 U

Baker

Baker Environmental, Inc.

APPENDIX E

Risk Assessment Data Sets

APPENDIX E

CURRENT SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Volatile Organic Compounds (ug/kg)						
1,1,1-Trichloroethane (TCA)	6 U	5 U	12 U	12 U	12 U	12 U
1,1,2,2-Tetrachloroethane	6 U	5 U	12 U	12 U	12 U	12 U
1,1,2-Trichloro-1,2,2-trifluoroethane	6 U	5 U	12 U	12 U	12 U	12 U
1,1,2-Trichloroethane	6 U	5 U	12 U	12 U	12 U	12 U
1,1-Dichloroethane	6 U	5 U	12 U	12 U	12 U	12 U
1,1-Dichloroethene	6 U	5 U	12 U	12 U	12 U	12 U
1,2,4-Trichlorobenzene	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dibromo-3-chloropropane (DBCP)	6 U	5 UJ	12 R	12 R	12 R	12 R
1,2-Dibromoethane (EDB)	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dichlorobenzene (o-)	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dichloroethane	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dichloroethene (cis)	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dichloroethene (trans)	6 U	5 U	12 U	12 U	12 U	12 U
1,2-Dichloropropane	6 U	5 U	12 U	12 U	12 U	12 U
1,3-Dichlorobenzene (m-)	6 U	5 U	12 U	12 U	12 U	12 U
1,3-Dichloropropene (cis)	6 U	5 U	12 U	12 U	12 U	12 U
1,3-Dichloropropene (trans)	6 U	5 U	12 U	12 U	12 U	12 U
1,4-Dichlorobenzene (p-)	14 U	12 U	12 U	12 U	12 U	12 U
2-Butanone (MEK)	14 U	12 U	12 U	12 U	12 U	12 U
2-Hexanone (MBK)	14 U	12 U	12 U	12 U	12 U	12 U
4-Methyl-2-pentanone (MIBK)	33	8 J	12 U	12 U	12 U	12 UJ
Acetone	6 U	5 U	12 U	12 U	12 U	12 U
Benzene	6 U	5 U	12 U	12 U	12 U	12 U
Bromodichloromethane	6 U	5 U	12 U	12 U	12 U	12 U
Bromoform	6 UJ	5 UJ	12 U	12 U	12 U	12 U
Bromomethane	6 U	5 U	12 U	12 U	12 U	12 U
Carbon Disulfide	6 U	5 U	12 U	12 U	12 U	12 U
Carbon Tetrachloride	6 U	5 U	12 U	12 U	12 U	12 U
Chlorobenzene	6 U	5 U	12 U	12 U	12 U	12 U
Chloroethane	6 U	5 U	12 U	12 U	12 U	12 U
Chloroform	6 U	5 U	12 U	12 U	12 U	12 U
Chloromethane	6 U	5 U	12 U	12 U	12 U	12 U
Cyclohexane	6 U	5 U	12 U	12 U	12 U	12 U
Dibromochloromethane	6 U	5 U	12 U	12 U	12 U	12 U
Dichlorodifluoroethane	6 U	5 U	12 U	12 U	12 U	12 U
Ethylbenzene	6 U	5 U	12 U	12 U	12 U	12 U
Isopropylbenzene (Cumene)	6 U	5 U	12 U	12 U	12 U	12 U
Methyl Acetate	6 U	5 U	12 U	12 U	12 U	12 U
Methyl Cyclohexane	6 U	5 U	12 U	12 U	12 U	12 U
Methyl Tert-Butyl Ether (MTBE)	6 U	5 U	12 U	12 U	12 U	12 U
Methylene Chloride	12	28	12 U	12 U	12 U	12 U
Styrene (Ethylbenzene)	6 U	5 U	12 U	12 U	12 U	12 U

APPENDIX E (Continued)

CURRENT SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Volatile Organic Compounds (ug/kg) (Cont)						
Tetrachloroethene (PCE)	6 U	5 U	12 U	12 U	12 U	12 U
Toluene	3 J	5 U	12 U	12 U	12 U	12 U
Trichloroethene (TCE)	6 U	5 U	12 U	12 U	12 U	12 U
Trichlorofluoromethane	6 U	5 U	12 U	12 U	12 U	12 U
Vinyl Chloride	6 U	5 U	12 U	12 U	12 U	12 U
Xylene, m/p-	NA	NA	12 U	12 U	12 U	12 U
Xylene, o-	NA	NA	12 U	12 U	12 U	12 U
Xylenes, total	1 J	14 U	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	400 U	380 U	NA	NA	NA	NA
2,2'-Oxybis[1-chloropropane]	400 U	380 U	NA	NA	NA	NA
2,4,5-Trichlorophenol	400 U	380 U	NA	NA	NA	NA
2,4,6-Trichlorophenol	400 U	380 U	NA	NA	NA	NA
2,4-Dichlorophenol	400 U	380 U	NA	NA	NA	NA
2,4-Dimethylphenol	400 U	380 U	NA	NA	NA	NA
2,4-Dinitrophenol	2100 UJ	2000 UJ	NA	NA	NA	NA
2,4-Dinitrotoluene	400 U	380 U	NA	NA	NA	NA
2,6-Dinitrotoluene	400 U	380 U	NA	NA	NA	NA
2-Chloronaphthalene	400 U	380 U	NA	NA	NA	NA
2-Chlorophenol	400 U	380 U	NA	NA	NA	NA
2-Methylnaphthalene	400 U	380 U	NA	NA	NA	NA
2-Methylphenol (o-Cresol)	400 U	380 U	NA	NA	NA	NA
2-Nitroaniline	800 U	760 U	NA	NA	NA	NA
2-Nitrophenol	400 U	380 U	NA	NA	NA	NA
3,3'-Dichlorobenzidine	800 U	760 U	NA	NA	NA	NA
3-Nitroaniline	800 U	760 U	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	800 U	760 U	NA	NA	NA	NA
4-Bromophenyl-phenylether	400 U	380 U	NA	NA	NA	NA
4-Chloro-3-methylphenol	400 U	380 U	NA	NA	NA	NA
4-Chloroaniline	400 U	380 U	NA	NA	NA	NA
4-Chlorophenyl-phenylether	400 U	380 U	NA	NA	NA	NA
4-Methylphenol (p-Cresol)	400 U	380 U	NA	NA	NA	NA
4-Nitroaniline	800 U	760 U	NA	NA	NA	NA
4-Nitrophenol	800 U	760 U	NA	NA	NA	NA
Acenaphthene	400 U	380 U	NA	NA	NA	NA
Acenaphthylene	400 U	380 U	NA	NA	NA	NA
Acetophenone	400 U	380 U	NA	NA	NA	NA
Anthracene	400 U	380 U	NA	NA	NA	NA
Atrazine	400 U	380 U	NA	NA	NA	NA
Benzaldehyde	400 U	380 U	NA	NA	NA	NA

APPENDIX E (Continued)

CURRENT SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Semivolatile Organic Compounds (ug/kg) (Cont)						
Benzo(a)anthracene	400 U	380 U	NA	NA	NA	NA
Benzo(a)pyrene	400 U	380 U	NA	NA	NA	NA
Benzo(b)fluoranthene	400 U	380 U	NA	NA	NA	NA
Benzo(g,h,i)perylene	400 U	380 U	NA	NA	NA	NA
Benzo(k)fluoranthene	400 U	380 U	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	400 U	380 U	NA	NA	NA	NA
Bis(2-chloroethyl)ether	400 U	380 U	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate (BEHP)	860	100 J	NA	NA	NA	NA
Butyl Benzyl Phthalate	860	380 U	NA	NA	NA	NA
Caprolactam	400 U	380 U	NA	NA	NA	NA
Carbazole	400 U	380 U	NA	NA	NA	NA
Chrysene	400 U	380 U	NA	NA	NA	NA
Dibenz(a,h)anthracene	400 U	380 U	NA	NA	NA	NA
Dibenzofuran	400 U	380 U	NA	NA	NA	NA
Diethyl Phthalate (DEP)	400 U	380 U	NA	NA	NA	NA
Dimethyl Phthalate	400 U	380 U	NA	NA	NA	NA
Di-n-butyl Phthalate (DBP)	400 U	380 U	NA	NA	NA	NA
Di-n-octyl Phthalate	110 J	380 U	NA	NA	NA	NA
Fluoranthene	400 U	380 U	NA	NA	NA	NA
Fluorene	400 U	380 U	NA	NA	NA	NA
Hexachlorobenzene	400 U	380 U	NA	NA	NA	NA
Hexachlorobutadiene	400 U	380 U	NA	NA	NA	NA
Hexachlorocyclopentadiene	400 U	380 U	NA	NA	NA	NA
Hexachloroethane	400 U	380 U	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	400 U	380 U	NA	NA	NA	NA
Isophorone	400 U	380 U	NA	NA	NA	NA
Naphthalene	400 U	380 U	NA	NA	NA	NA
Nitrobenzene	400 U	380 U	NA	NA	NA	NA
n-Nitrosodi-n-propylamine	400 U	380 U	NA	NA	NA	NA
n-Nitrosodiphenylamine	400 U	380 U	NA	NA	NA	NA
Pentachlorophenol	800 U	760 U	NA	NA	NA	NA
Phenanthrene	400 U	380 U	NA	NA	NA	NA
Phenol	400 U	380 U	NA	NA	NA	NA
Pyrene	400 U	380 U	NA	NA	NA	NA
Total Metals (mg/kg)						
Arsenic	0.3 J	0.68 J	0.64 U	0.66 U	0.81 J	0.63 U
Barium	17.6	48.2	13.6 J	12 J	10.8 J	11.1 J
Cadmium	1.8	4.4	0.49 J	0.09 U	0.15 J	0.27 J
Chromium	13.8	15.3	0.14 U	0.14 U	0.14 U	0.14 U
Lead	18.9 J	17.7 J	7.7	6.5	8.2	6.1
Mercury	0.06	0.06	0.11 U	0.11 U	0.11 U	0.12 U
Selenium	0.55 U	0.62	0.69 UJ	0.71 UJ	0.71 UJ	0.68 UJ
Silver	0.11 U	0.1 U	0.23 UJ	0.24 UJ	0.24 UJ	0.23 UJ

APPENDIX E (Continued)

FUTURE SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Sample Date	Sample Depth (ft)	Laboratory:	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
	03-20-2002	0-1	FIXED	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
				FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	MOBILE	MOBILE
Volatile Organic Compounds (ug/kg)												
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
1,1,1-Trichloroethane (TCA)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,1,2,2-Tetrachloroethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
1,1,2-Trichloro-1,2,2-trifluoroethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	NA	NA
1,1,2-Trichloroethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,1-Dichloroethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,1-Dichloropropene	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,1-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.20 U	1.09 U	1.18 U
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.87 J	5.46 U	5.88 U
1,2,3-Trichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
1,2,4-Trichlorobenzene	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	5.46 U	5.88 U
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
1,2-Dibromo-3-chloropropane (DBCP)	6 U	5 U	12 R	12 R	12 R	12 R	12 R	12 R	12 R	10 U	5.46 U	5.88 U
1,2-Dibromooethane (EDB)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
1,2-Dichlorobenzene (o-)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
1,2-Dichloroethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,2-Dichloroethene (cis)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 U	NA	NA
1,2-Dichloroethene (trans)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,2-Dichloropropane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
1,3-Dichlorobenzene (m-)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
1,3-Dichloropropene (cis)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,3-Dichloropropene (total)	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.20 U	1.09 U	1.18 U
1,3-Dichloropropene (trans)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
1,4-Dichlorobenzene (p-)	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
2,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.20 U	1.09 U	1.18 U
2-Butanone (MEK)	14 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	NA	NA
2-Chlorotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
2-Hexanone (MBK)	14 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	NA	NA
4-Chlorotoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
4-Isopropyltoluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
4-Methyl-2-pentanone (MIBK)	14 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Acetone	33	8 J	12 U	12 U	12 U	12 U	12 U	12 U	12 U	8 J	NA	NA
Benzene	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Bromobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
Bromodichloromethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Bromoform	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Bromomethane	6 U	5 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	10 U	5.46 U	4.50 J
Butylbenzene, sec-	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
Butylbenzene, tert-	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U

APPENDIX E (Continued)

FUTURE SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003	02/01/05	02/01/05	02/02/05
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	MOBILE	MOBILE
Volatile Organic Compounds (ug/kg) (Cont)									
Carbon Disulfide	6 U	5 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Carbon Tetrachloride	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Chlorobenzene	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Chloroethane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	5.46 U	5.88 U
Chloroform	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Chloromethane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	5.46 U	2.20 J
Cyclohexane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Dibromochloromethane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Dibromomethane	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
Dichlorodifluoromethane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	5.46 U	5.88 U
Ethylbenzene	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	6.01 U	5.46 U	5.88 U
Isopropylbenzene (Cumene)	6 U	5 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Methyl Acetate	6 U	5 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Methyl Cyclohexane	6 U	5 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Methyl Tert-Butyl Ether (MTBE)	6 U	5 U	12 U	12 U	12 U	12 U	10 U	NA	NA
Methylene Chloride	12	28	12 U	12 U	12 U	12 U	12 U	5.46 U	5.88 U
Naphthalene	NA	NA	NA	NA	NA	NA	1.10 J	5.46 U	5.88 U
n-Butylbenzene	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
n-Propylbenzene	NA	NA	NA	NA	NA	NA	2.40 U	2.19 U	2.35 U
Styrene (Ethenylbenzene)	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Tetrachloroethene (PCE)	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Toluene	3 J	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Trichloroethene (TCE)	6 U	5 U	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Trichlorofluoromethane	6 U	5 U	12 U	12 U	12 U	12 U	1 J	5.46 U	5.88 U
Vinyl Chloride	6 U	5 U	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Xylene, m/p-	NA	NA	12 U	12 U	12 U	12 U	10 U	2.19 U	2.35 U
Xylene, o-	NA	NA	12 U	12 U	12 U	12 U	10 U	1.09 U	1.18 U
Xylenes, total	1 J	14 U	NA	NA	NA	NA	10 U	NA	NA
Semivolatile Organic Compounds (ug/kg)									
1,1'-Biphenyl	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis[1-chloropropane]	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	2100 UJ	2000 UJ	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-Cresol)	400 U	380 U	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

FUTURE SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003	02/01/05	02/01/05	02/02/05
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	MOBILE	MOBILE
Semivolatile Organic Compounds (ug/kg) (Cont)									
2-Nitroaniline	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol (p-Cresol)	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Acetophenone	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Anthracene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Atrazine	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzaldehyde	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate (BEHP)	860	100 J	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	860	380 U	NA	NA	NA	NA	NA	NA	NA
Caprolactam	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Carbazole	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Chrysene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate (DEP)	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl Phthalate (DBP)	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl Phthalate	110 J	380 U	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Fluorene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	400 U	380 U	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

FUTURE SURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW04-00	SWMU336-TW05-00	SWMU336-TW06-00	SWMU336-SB01-00	SWMU336-SB04-00	SWMU336-SB09-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	06-23-2003	02/01/05	02/01/05	02/02/05
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	MOBILE	MOBILE
Semivolatile Organic Compounds (ug/kg) (Cont)									
Indeno(1,2,3-cd)pyrene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Isophorone	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Naphthalene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
n-Nitrosodi-n-propylamine	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
n-Nitrosodiphenylamine	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	800 U	760 U	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Phenol	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Pyrene	400 U	380 U	NA	NA	NA	NA	NA	NA	NA
Total Metals (mg/kg)									
Arsenic	0.3 J	0.68 J	0.64 U	0.66 U	0.81 J	0.63 U	1 U	NA	NA
Barium	17.6	48.2	13.6 J	12 J	10.8 J	11.1 J	10.4 J	NA	NA
Cadmium	1.8	4.4	0.49 J	0.09 U	0.15 J	0.27 J	0.05 U	NA	NA
Chromium	13.8	15.3	0.14 U	0.14 U	0.14 U	0.14 U	10.8	NA	NA
Lead	18.9 J	17.7 J	7.7	6.5	8.2	6.1	6	NA	NA
Mercury	0.06	0.06	0.11 U	0.11 U	0.11 U	0.12 U	0.07 U	NA	NA
Selenium	0.55 U	0.62	0.69 UJ	0.71 UJ	0.71 UJ	0.68 UJ	0.62 U	NA	NA
Silver	0.11 U	0.1 U	0.23 UJ	0.24 UJ	0.24 UJ	0.23 UJ	0.12 U	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-TW01-04	SWMU336-TW02-04	SWMU336-TW03-04	SWMU336-TW04-06	SWMU336-TW05-04	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	2/1/2005	2/1/2005	2/2/2005
Depth Range	7-9	7-9	7-9	11-13	7-9	3-5	3-5	11-13
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Volatile Organic Compounds (ug/kg)								
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane (TCA)	5 J	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1,2,2-Tetrachloroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1,2-Trichloro-1,2,2-trifluoroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1,2-Trichloroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1-Dichloroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1-Dichloroethene	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,1-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-chloropropane (DBCP)	6 U	6 UJ	12 R	14 R	12 R	11 U	NA	NA
1,2-Dibromoethane (EDB)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2-Dichlorobenzene (o-)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2-Dichloroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2-Dichloroethene (cis)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	11 U	NA	NA
1,2-Dichloroethene (trans)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,2-Dichloropropane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene (m-)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,3-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichloropropene (cis)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,3-Dichloropropene (trans)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
1,4-Dichlorobenzene (p-)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
2,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	16 U	14 U	12 U	14 U	12 U	4 J	NA	NA
2-Chlorotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone (MBK)	16 U	14 U	12 U	14 U	12 U	11 U	NA	NA
4-Chlorotoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Isopropyltoluene	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	16 U	14 U	12 U	14 U	12 U	3 J	NA	NA
Acetone	16 UJ	6 J	12 U	14 U	12 UJ	31	NA	NA
Benzene	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Bromobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromochloromethane	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Bromoform	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Bromomethane	6 UJ	6 UJ	12 U	14 U	12 U	11 U	NA	NA
Butylbenzene, sec-	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzene, tert-	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-TW01-04	SWMU336-TW02-04	SWMU336-TW03-04	SWMU336-TW04-06	SWMU336-TW05-04	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	2/1/2005	2/1/2005	2/2/2005
Depth Range	7-9	7-9	7-9	11-13	7-9	3-5	3-5	11-13
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Volatile Organic Compounds (ug/kg) (Cont)								
Carbon Disulfide	6 U	6 U	12 U	14 U	12 U	1 J	NA	NA
Carbon Tetrachloride	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Chlorobenzene	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Chloroethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Chloroform	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Chloromethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Cyclohexane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Dibromochloromethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Dibromomethane	NA	NA	NA	NA	NA	NA	NA	NA
Dichlorodifluoromethane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Ethylbenzene	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene (Cumene)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Methyl Acetate	6 U	6 U	12 U	14 U	12 U	15	NA	NA
Methyl Cyclohexane	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Methyl Tert-Butyl Ether (MTBE)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Methylene Chloride	41	9	12 U	14 U	12 U	20 U	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Styrene (Ethenylbenzene)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Tetrachloroethene (PCE)	7	6 U	12 U	14 U	12 U	11 U	NA	NA
Toluene	6 U	2 J	12 U	14 U	12 U	11 U	NA	NA
Trichloroethene (TCE)	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Trichlorofluoromethane	6 U	2 J	12 U	14 U	12 U	2 J	NA	NA
Vinyl Chloride	6 U	6 U	12 U	14 U	12 U	11 U	NA	NA
Xylene, m/p-	NA	NA	12 U	14 U	12 U	11 U	NA	NA
Xylene, o-	NA	NA	12 U	14 U	12 U	11 U	NA	NA
Xylenes, total	19 UJ	17 U	NA	NA	NA	11 U	NA	NA
Semivolatile Organic Compounds (ug/kg)								
1,1'-Biphenyl	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2,2'-Oxybis[1-chloropropane]	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	430 U	400 U	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	430 U	400 U	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	430 U	400 U	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	430 U	400 U	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	2200 UJ	2100 UJ	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2-Chlorophenol	430 U	400 U	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-Cresol)	430 U	400 U	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-TW01-04	SWMU336-TW02-04	SWMU336-TW03-04	SWMU336-TW04-06	SWMU336-TW05-04	SWMU336-SB04-02	SWMU336-SB05-02	SWMU336-SB09-06
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003	2/1/2005	2/1/2005	2/2/2005
Depth Range	7-9	7-9	7-9	11-13	7-9	3-5	3-5	11-13
Laboratory:	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Semivolatile Organic Compounds (ug/kg) (Cont)								
2-Nitroaniline	870 UJ	800 U	NA	NA	NA	NA	NA	NA
2-Nitrophenol	430 U	400 U	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	870 UJ	800 U	NA	NA	NA	NA	NA	NA
3-Nitroaniline	870 UJ	800 U	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	870 U	800 U	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	430 UJ	400 U	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	430 U	400 U	NA	NA	NA	NA	NA	NA
4-Chloroaniline	430 UJ	400 U	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	430 UJ	400 U	NA	NA	NA	NA	NA	NA
4-Methylphenol (p-Cresol)	430 U	400 U	NA	NA	NA	NA	NA	NA
4-Nitroaniline	870 UJ	800 U	NA	NA	NA	NA	NA	NA
4-Nitrophenol	870 U	800 U	NA	NA	NA	NA	NA	NA
Acenaphthene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Acenaphthylene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Acetophenone	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Anthracene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Atrazine	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzaldehyde	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate (BEHP)	430 UJ	95 J	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Caprolactam	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Carbazole	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Chrysene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Dibenzofuran	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Diethyl Phthalate (DEP)	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Di-n-butyl Phthalate (DBP)	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Di-n-octyl Phthalate	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Fluoranthene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Fluorene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Hexachloroethane	430 UJ	400 U	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D. Sample Date Depth Range Laboratory:	SWMU336-TW01-04 03-20-2002 7-9 FIXED	SWMU336-TW02-04 03-20-2002 7-9 FIXED	SWMU336-TW03-04 06-23-2003 7-9 FIXED	SWMU336-TW04-06 06-23-2003 11-13 FIXED	SWMU336-TW05-04 06-23-2003 7-9 FIXED	SWMU336-SB04-02 2/1/2005 3-5 FIXED	SWMU336-SB05-02 2/1/2005 3-5 FIXED	SWMU336-SB09-06 2/2/2005 11-13 FIXED
Semi-volatile Organic Compounds (ug/kg) (Cont)								
Indeno(1,2,3-cd)pyrene	430 UJ							
Isophorone	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Naphthalene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Nitrobenzene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
n-Nitrosodi-n-propylamine	430 UJ	400 U	NA	NA	NA	NA	NA	NA
n-Nitrosodiphenylamine	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Pentachlorophenol	870 U	800 U	NA	NA	NA	NA	NA	NA
Phenanthrene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Phenol	430 U	400 U	NA	NA	NA	NA	NA	NA
Pyrene	430 UJ	400 U	NA	NA	NA	NA	NA	NA
Metals (mg/kg)								
Arsenic	0.32 U	0.28 U	0.68 U	0.76 U	0.68 U	1.2 U	1.1 U	0.86 U
Barium	11.5	7.1	12.5 J	11.1 J	15.1 J	17.7 J	16.2 J	9.5 J
Cadmium	0.04 U	0.04 U	0.1 U	0.11 U	0.12 J	0.06 U	0.06 U	0.07 U
Chromium	11.6	9.5	0.15 U	0.16 U	0.15 U	1.63	19.8	6.2
Lead	5.5 J	4.5 J	6.5	6.6	8	10	9.4	6.1
Mercury	0.03 J	0.03 J	0.12 U	0.12 U	0.12 U	0.04 U	0.04 U	0.04 U
Selenium	0.61 U	0.54 U	0.77 J	0.81 UJ	0.73 UJ	0.8 U	0.77 U	0.61 U
Silver	0.12 U	0.11 U	0.24 UJ	0.27 UJ	0.24 UJ	0.15 U	0.15 U	0.12 U

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02	SWMU336-SB05-05	SWMU336-SB09-03
Sample Date	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/2/2005
Depth Range	3-5	7-9	3-5	7-9	1-3	3-5	11-13	5-7
Laboratory:	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Volatile Organic Compounds (ug/kg)								
1,1,1,2-Tetrachloroethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,1,1-Trichloroethane (TCA)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,1,2,2-Tetrachloroethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,1-Dichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,1-Dichloroethene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,1-Dichloropropene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,2,3-Trichlorobenzene	6.11 U	6.11 U	0.65 J	6.36 U	5.54 U	1.20 J	6.41 U	5.87 U
1,2,3-Trichloropropane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,2,4-Trichlorobenzene	6.11 U	6.11 U	0.67 J	6.36 U	5.54 U	1.00 J	6.41 U	5.87 U
1,2,4-Trimethylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	170.00	1.70 J	2.56 U	2.35 U
1,2-Dibromo-3-chloropropane (DBCP)	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
1,2-Dibromoethane (EDB)	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,2-Dichlorobenzene (o-)	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,2-Dichloroethane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,2-Dichloroethene (cis)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (trans)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,2-Dichloropropane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,3,5-Trimethylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	130.00	1.10 J	2.56 U	2.35 U
1,3-Dichlorobenzene (m-)	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
1,3-Dichloropropane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,3-Dichloropropene (cis)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,3-Dichloropropene (trans)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
1,4-Dichlorobenzene (p-)	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
2,2-Dichloropropane	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
2-Hexanone (MBK)	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorotoluene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
4-Isopropyltoluene	2.44 U	2.44 U	2.33 U	2.50 U	32.00	2.50 U	2.56 U	2.35 U
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Bromobenzene	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Bromochloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Bromodichloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Bromoform	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Bromomethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Butylbenzene, sec-	2.44 U	2.44 U	2.33 U	2.50 U	25.00	2.50 U	2.56 U	2.35 U
Butylbenzene, tert-	2.44 U	2.44 U	2.33 U	2.50 U	8.40	2.50 U	2.56 U	2.35 U

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02	SWMU336-SB05-05	SWMU336-SB09-03
Sample Date	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/2/2005
Depth Range	3-5	7-9	3-5	7-9	1-3	3-5	11-13	5-7
Laboratory:	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Volatile Organic Compounds (ug/kg) (t								
Carbon Disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Chlorobenzene	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Chloroethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Chloroform	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Chloromethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Dibromomethane	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.56 U	2.35 U
Dichlorodifluoromethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Ethylbenzene	1.22 U	1.17 U	1.17 U	1.27 U	1.26 U	1.26 U	1.28 U	1.17 U
Hexachlorobutadiene	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Isopropylbenzene (Cumene)	2.44 U	2.44 U	2.33 U	2.50 U	7.90	2.50 U	2.56 U	2.35 U
Methyl Acetate	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Tert-Butyl Ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Naphthalene	6.11 U	6.11 U	3.80 J	6.36 U	5.54 U	1.40 J	6.41 U	5.87 U
n-Butylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	48.00	0.59 J	2.56 U	2.35 U
n-Propylbenzene	2.44 U	2.44 U	2.33 U	2.50 U	17.00	2.50 U	2.56 U	2.35 U
Styrene (Ethenylbenzene)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Tetrachloroethene (PCE)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Toluene	1.22 U	1.22 U	1.17 U	1.27 U	0.63 J	1.26 U	1.28 U	1.17 U
Trichloroethene (TCE)	1.22 U	1.22 U	1.17 U	1.27 U	1.11 U	1.26 U	1.28 U	1.17 U
Trichlorofluoromethane	6.11 U	6.11 U	5.83 U	6.36 U	5.54 U	6.30 U	6.41 U	5.87 U
Vinyl Chloride	2.44 U	2.44 U	2.33 U	2.50 U	2.22 U	2.50 U	2.60 U	2.35 U
Xylene, m/p-	2.44 U	2.44 U	2.33 U	2.50 U	5.80	2.50 U	2.56 U	2.35 U
Xylene, o-	1.22 U	1.22 U	1.17 U	1.27 U	4.50	1.26 U	1.28 U	1.17 U
Xylenes, total	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/l								
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA
2,2'-Oxybis[1-chloropropane]	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol (o-Cresol)	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02	SWMU336-SB05-05	SWMU336-SB09-03
Sample Date	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/2/2005
Depth Range	3-5	7-9	3-5	7-9	1-3	3-5	11-13	5-7
Laboratory:	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Semivolatile Organic Compounds (ug/l)								
2-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Bromophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Chlorophenyl-phenylether	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol (p-Cresol)	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Atrazine	NA	NA	NA	NA	NA	NA	NA	NA
Benzaldehyde	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) Phthalate (BEHP)	NA	NA	NA	NA	NA	NA	NA	NA
Butyl Benzyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Caprolactam	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA
Diethyl Phthalate (DEP)	NA	NA	NA	NA	NA	NA	NA	NA
Dimethyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl Phthalate (DBP)	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl Phthalate	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

SUBSURFACE SOIL ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

Site Sample I.D.	SWMU336-SB01-02	SWMU336-SB01-04	SWMU336-SB04-02	SWMU336-SB04-04	SWMU336-SB05-01	SWMU336-SB05-02	SWMU336-SB05-05	SWMU336-SB09-03
Sample Date	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/2/2005
Depth Range	3-5	7-9	3-5	7-9	1-3	3-5	11-13	5-7
Laboratory:	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Semivolatile Organic Compounds (ug/l)								
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	NA	NA	NA	NA	NA	NA	NA	NA
n-Nitrosodi-n-propylamine	NA	NA	NA	NA	NA	NA	NA	NA
n-Nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/kg)								
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX E (Continued)

GROUNDWATER ANALYTICAL RESULTS
SWMU 336
RCRA INVESTIGATION - CTO-0091
MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID SAMPLE DATE	SWMU336-GW01 04-03-2002 HIST	SWMU336-GW02 04-03-2002 HIST	SWMU336-TW03 07-16-2003 HIST	SWMU336-TW04 07-16-2003 HIST	SWMU336-TW05 07-16-2003 HIST	SWMU336-TW06 07-16-2003 HIST	SWMU336-GW04-01 2/1/2005 FIXED	SWMU336-GW09-01 2/2/2005 FIXED	SWMU336-GW01 2/1/2005 MOBILE
Volatile Organic Compounds (ug/l)									
1,1,1,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
1,1,1-Trichloroethane (TCA)	19	5 U	2.8 J	10 U	10 U	1.4 J	10 U	10 U	1 U
1,1,2,2-Tetrachloroethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	5 U	1 J	10 U	10 U	10 U	10 U	10 U	10 U	NA
1,1,2-Trichloroethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,1-Dichloroethane	21	5 U	10 U	10 U	10 U	1.4 J	10 U	10 U	1 U
1,1-Dichloroethene	2 J	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,1-Dichloropropene	NA	NA	NA	NA	NA	NA	1 U	NA	1 U
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	5 U	NA	5 U
1,2,3-Trichloropropane	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
1,2,4-Trichlorobenzene	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
1,2-Dibromo-3-chloropropane (DBCP)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
1,2-Dibromoethane (EDB)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
1,2-Dichlorobenzene (o-)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
1,2-Dichloroethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,2-Dichloroethene (cis)	0.8 J	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	10 U	10 U	NA
1,2-Dichloroethene (trans)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,2-Dichloropropane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
1,3-Dichlorobenzene (m-)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
1,3-Dichloropropane	NA	NA	NA	NA	NA	NA	1 U	NA	1 U
1,3-Dichloropropene (cis)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,3-Dichloropropene (trans)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
1,4-Dichlorobenzene (p-)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
2,2-Dichloropropane	NA	NA	NA	NA	NA	NA	1 U	NA	1 U
2-Butanone (MEK)	13 U	13 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
2-Chlorotoluene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
2-Hexanone (MBK)	13 U	13 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
4-Chlorotoluene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
4-Isopropyltoluene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
4-Methyl-2-pentanone (MIBK)	13 U	13 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Acetone	6 U	6 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Benzene	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Bromobenzene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
Bromochloromethane	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
Bromodichloromethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Bromoform	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Bromomethane	5 UJ	5 UJ	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Butylbenzene, sec-	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
Butylbenzene, tert-	NA	NA	NA	NA	NA	NA	2 U	NA	2 U

APPENDIX E (Continued)

GROUNDWATER ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID SAMPLE DATE	SWMU336-GW01 04-03-2002	SWMU336-GW02 04-03-2002	SWMU336-TW03 07-16-2003	SWMU336-TW04 07-16-2003	SWMU336-TW05 07-16-2003	SWMU336-TW06 07-16-2003	SWMU336-GW04-01 2/1/2005	SWMU336-GW09-01 2/2/2005	SWMU336-GW01 2/1/2005
	HIST	HIST	HIST	HIST	HIST	HIST	FIXED	FIXED	MOBILE
Volatile Organic Compounds (ug/l) (Cont)									
Carbon Disulfide	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Carbon Tetrachloride	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Chlorobenzene	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Chloroethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Chloroform	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Chloromethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Cyclohexane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Dibromochloromethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Dibromomethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Dichlorodifluoromethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Ethylbenzene	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	5 U	NA	5 U
Isopropylbenzene (Cumene)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Methyl Acetate	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Methyl Cyclohexane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Methyl Tert-Butyl Ether (MTBE)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	NA
Methylene Chloride	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Naphthalene	NA	NA	NA	NA	NA	NA	5 U	NA	5 U
n-Butylbenzene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
n-Propylbenzene	NA	NA	NA	NA	NA	NA	2 U	NA	2 U
Styrene (Ethylbenzene)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Tetrachloroethene (PCE)	27	5 U	13	10 U	10 U	2.3 J	10 U	10 U	1 U
Toluene	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Trichloroethene (TCE)	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	1 U
Trichlorofluoromethane	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	5 U
Vinyl Chloride	5 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	2 U
Xylene, m/p-	NA	NA	20 U	20 U	1.7 J	20 U	10 U	10 U	2 U
Xylene, o-	NA	NA	10 U	10 U	0.94 J	10 U	10 U	10 U	1 U
Xylenes, total	5 U	5 U	NA	NA	NA	NA	10 U	10 U	NA
Metals (ug/L)									
Arsenic	2.4 U	2.4 U	3.6 U	3.6 U	3.6 U	3.6 U	NA	NA	NA
Barium	29.3 J	55.2 J	161 J	46.4 J	10.9 J	67.5 J	NA	NA	NA
Cadmium	1 U	1.3 U	1 U	1 U	1 U	1 U	NA	NA	NA
Chromium	0.84 J	2 J	0.8 U	0.8 U	0.8 U	0.8 U	NA	NA	NA
Lead	1.8 U	2.6 J	1.6 U	1.6 U	1.6 U	1.6 U	NA	NA	NA
Mercury	0.1 U	0.1 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA
Selenium	4.6 U	4.6 U	2.6 U	2.6 U	2.6 U	2.6 U	NA	NA	NA
Silver	0.9 U	0.9 U	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ	NA	NA	NA

APPENDIX E (Continued)

GROUNDWATER ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	SWMU336-GW01-01	SWMU336-GW04	SWMU336-GW05	SWMU336-GW08-01	SWMU336-GW08	SWMU336-GW09-01	SWMU336-GW09-01
SAMPLE DATE	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/4/2005	2/2/2005	2/2/2005
	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Volatiles Organic Compounds (ug/l)							
1,1,1,2-Tetrachloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2,2-Tetrachloroethane	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloro-1,2,2-trifluoroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	5 U	5 U	5 U	0.73 J	0.73 J	5 U	0.52 J
1,2,3-Trichloropropane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2,4-Trichlorobenzene	5 U	5 U	5 U	0.66 J	0.66 J	5 U	5 U
1,2,4-Trimethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dibromo-3-chloropropane (DBCP)	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dibromoethane (EDB)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichlorobenzene (o-)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane (cis)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (total)	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethene (trans)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichlorobenzene (m-)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropene (cis)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropene (trans)	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene (p-)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,2-Dichloropropane	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	NA	NA	NA	NA	NA	NA	NA
2-Chlorotoluene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2-Hexanone (MBK)	NA	NA	NA	NA	NA	NA	NA
4-Chlorotoluene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
4-Isopropyltoluene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA
Benzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Butylbenzene, sec-	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Butylbenzene, tert-	2 U	2 U	2 U	2 U	2 U	2 U	2 U

APPENDIX E (Continued)

GROUNDWATER ANALYTICAL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

SAMPLE ID	SWMU336-GW01-01	SWMU336-GW04	SWMU336-GW05	SWMU336-GW05-01	SWMU336-GW08	SWMU336-GW08-01	SWMU336-GW09	SWMU336-GW09-01
SAMPLE DATE	2/1/2005	2/1/2005	2/1/2005	2/1/2005	2/4/2005	2/4/2005	2/2/2005	2/2/2005
	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE	MOBILE
Volatile Organic Compounds (ug/l) (Ct)								
Carbon Disulfide	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dibromomethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Dichlorodifluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Isopropylbenzene (Cumene)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Cyclohexane	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Tert-Butyl Ether (MTBE)	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Naphthalene	5 U	5 U	5 U	5 U	1 J	5	0.85 J	1.4 J
n-Butylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
n-Propylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Styrene (Ethenylbenzene)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene (PCE)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	1 U	1 U	1 U	1 U	1 U	1 U	0.33 J	1 U
Trichloroethene (TCE)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Xylene, m/p-	2 U	2 U	2 U	2 U	2 U	2 U	0.4 J	2 U
Xylene, o-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes, total	NA	NA	NA	NA	NA	NA	NA	NA
Metals (ug/L)								
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA

RAGS Part D Tables

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
SWMU 336
RCRA FACILITY INVESTIGATION (CFO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Surface Soil	Surface Soil	Surface Soil	Military Base Personnel	Adult	Ingestion Dermal	Quantitative	Current personnel may access site for work/training related activities
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
	Subsurface Soil	Subsurface Soil	Subsurface Soil	Military Base Personnel	Adult	Ingestion Dermal	Quantitative	Current personnel may access site for work/training related activities
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
	Groundwater	Groundwater	Groundwater	Military Base Personnel	Adult	Ingestion Dermal	NA	Not currently exposed to this medium.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
	Air	Air	Air	Military Base Personnel	Adult	Ingestion Dermal	NA	Not currently exposed to this medium.
				Construction Workers	Adult	Ingestion Dermal	NA	Not a current receptor.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not a current receptor.
				Residents	Adult and Young Child	Ingestion Dermal	NA	Not a current receptor.
	Volatilization during Showering Vapor Migration to Indoor Air	Air	Volatilization during Showering Vapor Migration to Indoor Air	Military Base Personnel	Adult	Inhalation	NA	Not a current receptor.
				Construction Workers	Adult	Inhalation	NA	Not a current receptor.
				Trespassers	Adolescent	Inhalation	NA	Not a current receptor.
				Residents	Adult and Young Child	Inhalation	NA	Not a current receptor.

TABLE 1 (Continued)
SELECTION OF EXPOSURE PATHWAYS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Surface Soil	Surface Soil	Surface Soil	Military Base Personnel	Adult	Ingestion Dermal	NA	Not anticipated as a future receptor.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adolescent	Ingestion Dermal	Quantitative	Future potential access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Air	Fugitive Dusts	Military Base Personnel	Adult	Ingestion Dermal	NA	Not anticipated as a future receptor.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adolescent	Ingestion Dermal	Quantitative	Future potential access of the site without permission
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Subsurface Soil	Subsurface Soil	Military Base Personnel	Adult	Ingestion Dermal	NA	Not anticipated as a future receptor.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not expected to be exposed to media.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Air	Fugitive Dusts	Military Base Personnel	Adult	Ingestion Dermal	NA	Not anticipated as a future receptor.
				Construction Workers	Adult	Ingestion Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not expected to be exposed to media.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
	Groundwater	Groundwater	Groundwater	Military Base Personnel	Adult	Ingestion Dermal	NA	Not anticipated as a future receptor.
				Construction Workers	Adult	Dermal	Quantitative	Future potential excavation or construction activities for development.
				Trespassers	Adolescent	Ingestion Dermal	NA	Not expected to be exposed to media.
				Residents	Adult and Young Child	Ingestion Dermal	Quantitative	Future potential residential development.
		Air	Volatilization during Showering	Residents	Adult	Inhalation	Quantitative	Future potential residential development.
			Vapor Migration to Indoor Air	Construction Workers	Adult	Dermal	Qualitative	Future potential excavation or construction activities for development.
				Residents	Adult	Inhalation	Qualitative	Future potential residential development.

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		Volatile Organic Compounds (ug/kg)													
	630-20-6	1,1,1,2-Tetrachloroethane	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	3.19E+03 C	N/A	N/A	NO	ND
	71-55-6	1,1,1-Trichloroethane (TCA)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.98E+05 N	N/A	N/A	NO	ND
	79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	4.08E+02 C	N/A	N/A	NO	ND
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.09E+06 N	N/A	N/A	NO	ND
	79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	7.29E+02 C	N/A	N/A	NO	ND
	75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	5.06E+04 N	N/A	N/A	NO	ND
	75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.24E+04 N	N/A	N/A	NO	ND
	563-58-6	1,1-Dichloropropene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	N/A	N/A	N/A	NO	ND
	87-61-6	1,2,3-Trichlorobenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	6.22E+03 N ⁽¹⁾	N/A	N/A	NO	ND
	96-19-5	1,2,3-Trichloropropene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.20E+02 N	N/A	N/A	NO	ND
	120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	6.22E+03 N	N/A	N/A	NO	ND
	95-63-6	1,2,4-Trimethylbenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.16E+03 N	N/A	N/A	NO	ND
	96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	ND	0/2	5UJ - 6U	ND	NA	4.60E+02 C	N/A	N/A	NO	ND
	106-93-4	1,2-Dibromoethane (EDB)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.20E+01 C	N/A	N/A	NO	ND
	95-50-1	1,2-Dichlorobenzene (o-)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.10E+05 N	N/A	N/A	NO	ND
	107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.78E+02 C	N/A	N/A	NO	ND
	156-59-2	1,2-Dichloroethene (cis)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	4.29E+03 N	N/A	N/A	NO	ND
	540-59-0	1,2-Dichloroethene (total)	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	4.29E+03 N ⁽¹⁾	N/A	N/A	NO	ND
	156-60-5	1,2-Dichloroethene (trans)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	6.95E+03 N	N/A	N/A	NO	ND
	78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.42E+02 C	N/A	N/A	NO	ND
	108-67-8	1,3,5-Trimethylbenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	2.13E+03 N	N/A	N/A	NO	ND
	541-73-1	1,3-Dichlorobenzene (m-)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	5.31E+04 N	N/A	N/A	NO	ND
	10061-01-5	1,3-Dichloropropene (cis)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	542-75-6	1,3-Dichloropropene (total)	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	7.77E+02 C	N/A	N/A	NO	ND
	10061-02-6	1,3-Dichloropropene (trans)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	106-46-7	1,4-Dichlorobenzene (p-)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.45E+03 C	N/A	N/A	NO	ND
	594-20-7	2,2-Dichloropropane	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	N/A	N/A	N/A	NO	ND
	78-93-3	2-Butanone (MEK)	ND	ND	µg/kg	ND	0/6	12U - 14U	ND	NA	2.23E+06 N	N/A	N/A	NO	ND
	95-49-8	2-Chlorotoluene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	1.58E+04 N	N/A	N/A	NO	ND
	591-78-6	2-Hexanone (MBK)	ND	ND	µg/kg	ND	0/6	12U - 14U	ND	NA	N/A	N/A	N/A	NO	ND
	106-43-4	4-Chlorotoluene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	N/A	N/A	N/A	NO	ND
	99-87-6	4-Isopropyltoluene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.72E+04 N ⁽¹⁰⁾	N/A	N/A	NO	ND
	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	ND	µg/kg	ND	0/6	12U - 14U	ND	NA	5.28E+05 N	N/A	N/A	NO	ND
	67-64-1	Acetone	8 J	33	µg/kg	SWMU336-TW01-00	2/6	12UJ - 12UJ	33	NA	1.41E+06 N	N/A	N/A	NO	BSL
	71-43-2	Benzene	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	6.43E+02 C	N/A	N/A	NO	ND
	108-86-1	Bromobenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	2.78E+03 N	N/A	N/A	NO	ND
	74-97-5	Bromochloromethane	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	N/A	N/A	N/A	NO	ND
	75-27-4	Bromodichloromethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	8.24E+02 C	N/A	N/A	NO	ND
	75-25-2	Bromoform	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	6.16E+04 C	N/A	N/A	NO	ND
	74-83-9	Bromomethane	ND	ND	µg/kg	ND	0/6	5UJ - 12U	ND	NA	3.90E+02 N	N/A	N/A	NO	ND
	135-98-8	Butylbenzene, sec-	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	4.46E+04 N	N/A	N/A	NO	ND
	98-06-6	Butylbenzene, tert-	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.26E+04 N	N/A	N/A	NO	ND
	75-15-0	Carbon Disulfide	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.55E+04 N	N/A	N/A	NO	ND
	56-23-5	Carbon Tetrachloride	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.51E+02 C	N/A	N/A	NO	ND

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	108-90-7	Chlorobenzene	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.51E+04 N	N/A	N/A	NO	ND
	75-00-3	Chloroethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.03E+03 C	N/A	N/A	NO	ND
	67-66-3	Chloroform	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.21E+02 C	N/A	N/A	NO	ND
	74-87-3	Chloromethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	4.69E+03 N	N/A	N/A	NO	ND
	110-82-7	Cyclohexane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.84E+05 N	N/A	N/A	NO	ND
	124-48-1	Dibromochloromethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.11E+03 C	N/A	N/A	NO	ND
	74-95-3	Dibromomethane	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	6.69E+03 N	N/A	N/A	NO	ND
	75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	9.39E+03 N	N/A	N/A	NO	ND
	100-41-4	Ethylbenzene	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	1.86E+05 N	N/A	N/A	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	98-82-8	Isopropylbenzene (Cumene)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	5.72E+04 N	N/A	N/A	NO	ND
	79-20-9	Methyl Acetate	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.21E+06 N	N/A	N/A	NO	ND
	108-87-2	Methyl Cyclohexane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	2.59E+05 N	N/A	N/A	NO	ND
	1634-04-4	Methyl Tert-Butyl Ether (MTBE)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.20E+04 C	N/A	N/A	NO	ND
	75-09-2	Methylene Chloride	12	28	µg/kg	SWMU336-TW02-00	2/6	12U - 12U	28	NA	9.11E+03 C	N/A	N/A	NO	BSL
	91-20-3	Naphthalene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.59E+03 N	N/A	N/A	NO	ND
	104-51-8	n-Butylbenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.79E+04 N	N/A	N/A	NO	ND
	103-65-1	n-Propylbenzene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.79E+04 N	N/A	N/A	NO	ND
	100-42-5	Styrene (Ethenylbenzene)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	4.38E+05 N	N/A	N/A	NO	ND
	127-18-4	Tetrachloroethene (PCE)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	4.84E+02 C	N/A	N/A	NO	ND
	108-88-3	Toluene	3 J	3 J	µg/kg	SWMU336-TW01-00	1/6	5U - 12U	3	NA	6.56E+04 N	N/A	N/A	NO	BSL
	79-01-6	Trichloroethene (TCE)	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	5.30E+01 C	N/A	N/A	NO	ND
	75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	3.86E+04 N	N/A	N/A	NO	ND
	75-01-4	Vinyl Chloride	ND	ND	µg/kg	ND	0/6	5U - 12U	ND	NA	7.91E+01 C	N/A	N/A	NO	ND
	000000-01-4	Xylene, m/p-	ND	ND	µg/kg	ND	0/4	12U - 12U	ND	NA	2.71E+04 N ⁽¹¹⁾	N/A	N/A	NO	ND
	95-47-6	Xylene, o-	ND	ND	µg/kg	ND	0/4	12U - 12U	ND	NA	2.71E+04 N ⁽¹¹⁾	N/A	N/A	NO	ND
	1330-20-7	Xylenes, total	1 J	1 J	µg/kg	SWMU336-TW01-00	1/2	14U - 14U	1	NA	2.71E+04 N	N/A	N/A	NO	BSL
		Semivolatile Organic Compounds (ug/Kg)													
	92-52-4	1,1'-Biphenyl	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.01E+05 N	N/A	N/A	NO	ND
	108-60-1	2,2'-Oxybis[1-chloropropane]	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.88E+03 C	N/A	N/A	NO	ND
	95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.22E+05 N	N/A	N/A	NO	ND
	51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	ND	0/2	2000U - 2100U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+03 N	N/A	N/A	NO	ND
	91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	4.94E+05 N	N/A	N/A	NO	ND
	95-57-8	2-Chlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.34E+03 N	N/A	N/A	NO	ND
	91-57-6	2-Methylnaphthalene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	5.59E+03 N ⁽¹¹⁾	N/A	N/A	NO	ND
	95-48-7	2-Methylphenol (o-Cresol)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+05 N	N/A	N/A	NO	ND
	88-74-4	2-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	88-75-5	2-Nitrophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.08E+03 C	N/A	N/A	NO	ND
	99-09-2	3-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.83E+03 N	N/A	N/A	NO	ND

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	534-52-1	Semivolatile Organic Compounds (ug/kg) (Cont'	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	101-53-3	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	59-50-7	4-Bromophenyl-phenylether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	106-47-8	4-Chloro-3-methylphenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.44E+04 N	N/A	N/A	NO	ND
	7005-72-3	4-Chloroaniline	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	106-44-5	4-Chlorophenyl-phenylether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+04 N	N/A	N/A	NO	ND
	100-01-6	4-Methylphenol (p-Cresol)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+04 C	N/A	N/A	NO	ND
	100-02-7	4-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	N/A	N/A	N/A	NO	ND
	83-32-9	4-Nitrophenol	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	N/A	N/A	N/A	NO	ND
	208-96-8	Acenaphthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.68E+05 N	N/A	N/A	NO	ND
	98-86-2	Acenaphthylene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.68E+05 N ⁽¹¹⁾	N/A	N/A	NO	ND
	120-12-7	Acetophenone	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	1912-24-9	Anthracene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.19E+06 N	N/A	N/A	NO	ND
	100-52-7	Atrazine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.19E+03 C	N/A	N/A	NO	ND
	56-55-3	Benzaldehyde	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	50-32-8	Benzo(a)anthracene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	205-99-2	Benzo(a)pyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+01 C	N/A	N/A	NO	ND
	191-24-2	Benzo(b)fluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	207-08-9	Benzo(g,h,i)perylene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N ⁽¹⁴⁾	N/A	N/A	NO	ND
	111-91-1	Benzo(k)fluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+03 C	N/A	N/A	NO	ND
	111-44-4	Bis(2-chloroethoxy)methane	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	117-81-7	Bis(2-chloroethyl)ether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.18E+02 C	N/A	N/A	NO	ND
	85-68-7	Bis(2-ethylhexyl) Phthalate (BEHP)	100 J	860	µg/kg	SWMU336-TW01-00	2/2	(6)	860	NA	3.47E+04 C	N/A	N/A	NO	BSL
	105-60-2	Butyl Benzyl Phthalate	860	860	µg/kg	SWMU336-TW01-00	1/2	380U - 380U	860	NA	1.22E+06 N	N/A	N/A	NO	BSL
	86-74-8	Caprolactam	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+06 N	N/A	N/A	NO	ND
	218-01-9	Carbazole	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.43E+04 C	N/A	N/A	NO	ND
	53-70-3	Chrysene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+04 C	N/A	N/A	NO	ND
	132-64-9	Dibenz(a,h)anthracene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+01 C	N/A	N/A	NO	ND
	84-66-2	Dibenzofuran	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.45E+04 N	N/A	N/A	NO	ND
	131-11-3	Diethyl Phthalate (DEP)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	4.89E+06 N	N/A	N/A	NO	ND
	84-74-2	Dimethyl Phthalate	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+07 N	N/A	N/A	NO	ND
	117-84-0	Di-n-butyl Phthalate (DBP)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	206-44-0	Di-n-octyl Phthalate	110 J	110 J	µg/kg	SWMU336-TW01-00	1/2	380U - 380U	110	NA	2.44E+05 N	N/A	N/A	NO	BSL
	86-73-7	Fluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.29E+05 N	N/A	N/A	NO	ND
	118-74-1	Fluorene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.75E+05 N	N/A	N/A	NO	ND
	87-68-3	Hexachlorobenzene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.04E+02 C	N/A	N/A	NO	ND
	77-47-4	Hexachlorobutadiene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	67-72-1	Hexachlorocyclopentadiene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.65E+04 N	N/A	N/A	NO	ND
	193-39-5	Hexachloroethane	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.47E+04 C	N/A	N/A	NO	ND
	78-59-1	Indeno(1,2,3-cd)pyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	91-20-3	Isophorone	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	5.12E+05 C	N/A	N/A	NO	ND
	98-95-3	Naphthalene	ND	ND	µg/kg	ND	0/0	(6)	ND	NA	5.59E+03 N	N/A	N/A	NO	ND
	621-64-7	Nitrobenzene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.96E+03 N	N/A	N/A	NO	ND
	86-30-6	n-Nitrosodi-n-propylamine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.95E+01 C	N/A	N/A	NO	ND
		n-Nitrosodiphenylamine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	9.93E+04 C	N/A	N/A	NO	ND

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	87-86-5	Semivolatile Organic Compounds (ug/kg) (Cont'	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	2.98E+03 C	N/A	N/A	NO	ND
	85-01-8	Pentachlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N ⁽¹⁴⁾	N/A	N/A	NO	ND
	108-95-2	Phenanthrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.83E+06 N	N/A	N/A	NO	ND
	129-00-0	Pyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N	N/A	N/A	NO	ND
		Total Metals (mg/kg)													
	7440-38-2	Arsenic	0.3 J	0.81 J	mg/kg	SWMU336-TW05-00	3/6	0.63U - 0.66U	0.81	1.14	3.90E-01 C	N/A	N/A	NO	BKG
	7440-39-3	Barium	10.8 J	48.2	mg/kg	SWMU336-TW02-00	6/6	(6)	48.2	21.75	5.37E+02 N	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.15 J	4.4	mg/kg	SWMU336-TW02-00	5/6	0.09U - 0.09U	4.4	0.02	3.70E+00 N	N/A	N/A	NO	BSL
	7440-47-3	Chromium	13.8	15.3	mg/kg	SWMU336-TW02-00	2/6	0.14U - 0.14U	15.3	12.68	2.11E+02 C	N/A	N/A	NO	BSL
	7439-92-1	Lead	6.1	18.9 J	mg/kg	SWMU336-TW01-00	6/6	(6)	18.9	16.73	4.00E+02 N	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.06	0.06	mg/kg	SWMU336-TW01-00, SWMU336-TW02-00	2/6	0.11U - 0.12U	0.06	0.06	2.35E+00 N	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.62	0.62	mg/kg	SWMU336-TW02-00	1/6	0.55U - 0.71UJ	0.62	0.81	3.91E+01 N	N/A	N/A	NO	BSL
	7440-22-4	Silver	ND	ND	mg/kg	ND	0/6	0.1U - 0.24UJ	ND	0.12	3.91E+01 N	N/A	N/A	NO	ND

- (1) J - Analyte present - Reported value is estimated
U - Not detected
J - Reported quantitation limit is qualified as estimated

Definitions: N/A = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

- (2) Maximum concentration used for screening
(3) MCB Camp Lejeune Base Background Study, Final (Baker, 2001): 2 * Mean (1/2 nondetects) - AOC 2
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Region IX Residential Soil COC Screening Value (derived from USEPA Region IX PRG Table - October, 2004)
(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Background Levels (BKG)
Below Screening Level (BSL)

C = Carcinogenic mg/kg = milligrams per kilogram
N = Non-Carcinogenic ug/kg = microgram per kilogram

- (6) No detection limits given; analyte detected in every sample.
(7) Screening level for 1,2,4-Trichlorobenzene
(8) Screening value for 1,2-dichloroethene (cis) used as a surrogate.
(9) Screening value for 1,3-dichloropropene (total) used as a surrogate.
(10) Screening level for Isopropylbenzene
(11) Screening value for xylenes (total).
(12) Screening value for naphthalene used as a surrogate
(13) Screening value for acenaphthene used as a surrogate.
(14) Screening value for pyrene used as a surrogate.

TABLE 2.2
SWMU 336
OCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
RCRA FACILITY INVESTIGATION (CFO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Surface Soil	630-20-6	1,1,1,2-Tetrachloroethane	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	3.19E+03 C	N/A	N/A	NO	ND
	71-55-6	1,1,1-Trichloroethane (TCA)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	1.98E+05 N	N/A	N/A	NO	ND
	79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	4.08E+02 C	N/A	N/A	NO	ND
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	2.09E+06 N	N/A	N/A	NO	ND
	79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	7.29E+02 C	N/A	N/A	NO	ND
	75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	5.06E+04 N	N/A	N/A	NO	ND
	75-35-4	1,1-Dichloroethane	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	1.24E+04 N	N/A	N/A	NO	ND
	563-58-6	1,1-Dichloroethane	ND	ND	µg/kg	ND	0/3	1.09U - 12U	ND	NA	N/A	N/A	N/A	NO	ND
	87-61-6	1,2,3-Trichlorobenzene	0.87 J	0.87 J	µg/kg	SWMU336-SB01-00	1/3	5.46U - 5.88U	0.87	NA	6.22E+03 N ⁽¹⁾	N/A	N/A	NO	BSL
	96-19-5	1,2,3-Trichloropropene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.20E+02 N	N/A	N/A	NO	ND
	120-82-1	1,2,4-Trichlorobenzene	0.77 J	0.77 J	µg/kg	SWMU336-SB01-00	1/10	5U - 12U	0.77	NA	6.22E+03 N	N/A	N/A	NO	BSL
	95-63-6	1,2,4-Trimethylbenzene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.16E+03 N	N/A	N/A	NO	ND
	96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	ND	0/6	5U - 10U	ND	NA	4.60E+02 C	N/A	N/A	NO	ND
	106-93-4	1,2-Dichloroethane (EDB)	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	3.20E+01 C	N/A	N/A	NO	ND
	95-50-1	1,2-Dichlorobenzene (o-)	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	1.10E+05 N	N/A	N/A	NO	ND
	107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	2.78E+02 C	N/A	N/A	NO	ND
	156-59-2	1,2-Dichloroethane (cis)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	4.29E+03 N ⁽¹⁾	N/A	N/A	NO	ND
	540-59-0	1,2-Dichloroethane (total)	ND	ND	µg/kg	ND	0/1	10U - 10U	ND	NA	6.95E+03 N	N/A	N/A	NO	ND
	156-60-5	1,2-Dichloroethane (trans)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	3.42E+02 C	N/A	N/A	NO	ND
	78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	2.13E+03 N	N/A	N/A	NO	ND
	108-67-8	1,3,5-Trimethylbenzene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.31E+04 N	N/A	N/A	NO	ND
	541-73-1	1,3-Dichlorobenzene (m-)	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	10061-01-5	1,3-Dichloropropene (cis)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	542-75-6	1,3-Dichloropropene (total)	ND	ND	µg/kg	ND	0/3	1.09U - 12U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	10061-02-6	1,3-Dichloropropene (trans)	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	3.45E+03 C	N/A	N/A	NO	ND
	106-46-7	1,4-Dichlorobenzene (p-)	ND	ND	µg/kg	ND	0/3	1.09U - 12U	ND	NA	N/A	N/A	N/A	NO	ND
	594-20-7	2,2-Dichloropropane	ND	ND	µg/kg	ND	0/7	10U - 14U	ND	NA	2.23E+06 N	N/A	N/A	NO	ND
	78-93-3	2-Butanone (MEK)	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	1.58E+04 N	N/A	N/A	NO	ND
	95-49-8	2-Chlorotoluene	ND	ND	µg/kg	ND	0/3	10U - 14U	ND	NA	N/A	N/A	N/A	NO	ND
	591-78-6	2-Hexanone (MBK)	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	N/A	N/A	N/A	NO	ND
	106-43-4	4-Chlorotoluene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	N/A	N/A	N/A	NO	ND
	99-87-6	4-Isopropyltoluene	ND	ND	µg/kg	ND	0/7	10U - 14U	ND	NA	5.72E+04 N ⁽¹⁾	N/A	N/A	NO	ND
	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.28E+05 N	N/A	N/A	NO	BSL
	67-64-1	Acetone	8 J	33	µg/kg	SWMU336-TW01-00	3/7	12U - 12U	33	NA	1.41E+06 N	N/A	N/A	NO	ND
	71-43-2	Benzene	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	6.43E+02 C	N/A	N/A	NO	ND
	108-86-1	Bromobenzene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	2.78E+03 N	N/A	N/A	NO	ND
	74-97-5	Bromochloromethane	ND	ND	µg/kg	ND	0/3	2.19U - 12U	ND	NA	N/A	N/A	N/A	NO	ND
	75-27-4	Bromodichloromethane	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	8.24E+02 C	N/A	N/A	NO	ND
	75-25-2	Bromoform	ND	ND	µg/kg	ND	0/3	2.19U - 12U	ND	NA	6.16E+04 C	N/A	N/A	NO	BSL
	74-83-9	Bromomethane	4.5 J	4.5 J	µg/kg	SWMU336-SB09-00	1/10	5U - 12U	4.5	NA	3.90E+02 N	N/A	N/A	NO	ND
	135-98-8	Butylbenzene, sec-	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	4.46E+04 N	N/A	N/A	NO	ND
	98-06-6	Butylbenzene, tert-	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.26E+04 N	N/A	N/A	NO	ND
	75-15-0	Carbon Disulfide	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	3.55E+04 N	N/A	N/A	NO	ND
	56-23-5	Carbon Tetrachloride	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	2.51E+02 C	N/A	N/A	NO	ND

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		Volatile Organic Compounds (ug/kg)													
	108-90-7	Chlorobenzene	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	1.51E+04 N	N/A	N/A	NO	ND
	75-00-3	Chloroethane	ND	ND	µg/kg	ND	0/10	5U - 12U	ND	NA	3.03E+03 C	N/A	N/A	NO	ND
	67-66-3	Chloroform	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	2.21E+02 C	N/A	N/A	NO	ND
	74-87-3	Chloromethane	2.2 J	2.2 J	µg/kg	SWMU336-SB09-00	1/10	5U - 12U	2.2	NA	4.69E+03 N	N/A	N/A	NO	BSL
	110-82-7	Cyclohexane	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	2.84E+05 N	N/A	N/A	NO	ND
	124-48-1	Dibromochloromethane	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	1.11E+03 C	N/A	N/A	NO	ND
	74-95-3	Dibromomethane	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	6.69E+03 N	N/A	N/A	NO	ND
	75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	ND	0/10	5U - 12U	ND	NA	9.39E+03 N	N/A	N/A	NO	ND
	100-41-4	Ethylbenzene	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	1.86E+05 N	N/A	N/A	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	ND	0/3	5.46U - 6.01U	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	98-82-8	Isopropylbenzene (Cumene)	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	5.72E+04 N	N/A	N/A	NO	ND
	79-20-9	Methyl Acetate	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	2.21E+06 N	N/A	N/A	NO	ND
	108-87-2	Methyl Cyclohexane	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	2.59E+05 N	N/A	N/A	NO	ND
	1634-04-4	Methyl Tert-Butyl Ether (MTBE)	ND	ND	µg/kg	ND	0/7	5U - 12U	ND	NA	3.20E+04 C	N/A	N/A	NO	ND
	75-09-2	Methylene Chloride	12	28	µg/kg	SWMU336-TW02-00	2/10	5.46U - 12U	28	NA	9.11E+03 C	N/A	N/A	NO	BSL
	91-20-3	Naphthalene	1.1 J	1.1 J	µg/kg	SWMU336-SB01-00	1/3	5.46U - 5.88U	1.1	NA	5.59E+03 N	N/A	N/A	NO	BSL
	104-51-8	n-Butylbenzene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.79E+04 N	N/A	N/A	NO	ND
	103-65-1	n-Propylbenzene	ND	ND	µg/kg	ND	0/3	2.19U - 2.4U	ND	NA	5.79E+04 N	N/A	N/A	NO	ND
	100-42-5	Styrene (Ethenylbenzene)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	4.38E+05 N	N/A	N/A	NO	ND
	127-18-4	Tetrachloroethene (PCE)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	4.84E+02 C	N/A	N/A	NO	ND
	108-88-3	Toluene	3 J	3 J	µg/kg	SWMU336-TW01-00	1/10	1.09U - 12U	3	NA	6.56E+04 N	N/A	N/A	NO	BSL
	79-01-6	Trichloroethene (TCE)	ND	ND	µg/kg	ND	0/10	1.09U - 12U	ND	NA	5.30E+01 C	N/A	N/A	NO	ND
	75-69-4	Trichlorofluoromethane	1 J	1 J	µg/kg	SWMU336-SB01-00	1/10	5U - 12U	1	NA	3.86E+04 N	N/A	N/A	NO	BSL
	75-01-4	Vinyl Chloride	ND	ND	µg/kg	ND	0/10	2.19U - 12U	ND	NA	7.91E+01 C	N/A	N/A	NO	ND
	000000-01-4	Xylene, m/p-	ND	ND	µg/kg	ND	0/8	2.19U - 12U	ND	NA	2.71E+04 N ⁽¹¹⁾	N/A	N/A	NO	ND
	95-47-6	Xylene, o-	ND	ND	µg/kg	ND	0/8	1.09U - 12U	ND	NA	2.71E+04 N ⁽¹¹⁾	N/A	N/A	NO	ND
	1330-20-7	Xylenes, total	1 J	1 J	µg/kg	SWMU336-TW01-00	1/3	10U - 14U	1	NA	2.71E+04 N	N/A	N/A	NO	BSL
		Semivolatile Organic Compounds (ug/Kg)													
	92-52-4	1,1'-Biphenyl	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.01E+05 N	N/A	N/A	NO	ND
	108-60-1	2,2'-Oxybis[1-chloropropane]	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.88E+03 C	N/A	N/A	NO	ND
	95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.22E+05 N	N/A	N/A	NO	ND
	51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	ND	0/2	2000U - 2100U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+03 N	N/A	N/A	NO	ND
	91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	4.94E+05 N	N/A	N/A	NO	ND
	95-57-8	2-Chlorophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.34E+03 N	N/A	N/A	NO	ND
	91-57-6	2-Methylnaphthalene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	5.59E+03 N ⁽¹¹⁾	N/A	N/A	NO	ND
	95-48-7	2-Methylphenol (o-Cresol)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+05 N	N/A	N/A	NO	ND
	88-74-4	2-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	88-75-5	2-Nitrophenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.08E+03 C	N/A	N/A	NO	ND
	99-09-2	3-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	1.83E+03 N	N/A	N/A	NO	ND

TABLE 2.2
SWMU 336
OCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Surface Soil		Semivolatile Organic Compounds (ug/kg) (Cont.)	(1)	(1)					(2)	(3)	(4)				(5)
	534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	101-55-3	4-Bromophenyl-phenylether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.44E+04 N	N/A	N/A	NO	ND
	106-47-8	4-Chloroaniline	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	7005-72-3	4-Chlorophenyl-phenylether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+04 N	N/A	N/A	NO	ND
	106-44-5	4-Methylphenol (p-Cresol)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+04 C	N/A	N/A	NO	ND
	100-01-6	4-Nitroaniline	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	N/A	N/A	N/A	NO	ND
	100-02-7	4-Nitrophenol	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	3.68E+03 N	N/A	N/A	NO	ND
	83-32-9	Acenaphthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.68E+05 N ⁽¹⁾	N/A	N/A	NO	ND
	208-96-8	Acenaphthylene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	N/A	N/A	N/A	NO	ND
	98-86-2	Acetophenone	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.19E+06 N	N/A	N/A	NO	ND
	120-12-7	Aniline	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.19E+03 C	N/A	N/A	NO	ND
	1912-24-9	Atrazine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	100-52-7	Benzaldehyde	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	56-55-3	Benzalacetone	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	50-32-8	Benzalpyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	205-99-2	Benzobifluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	191-24-2	Benzofluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N ⁽¹⁾	N/A	N/A	NO	ND
	207-08-9	Benzofluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	111-91-1	Bis(2-chloroethoxy) methane	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	111-44-4	Bis(2-chloroethyl) ether	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	117-81-7	Bis(2-ethylhexyl) Phthalate (BEHP)	100 J	860	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	83-68-7	Bis(2-ethylhexyl) Phthalate	860	860	µg/kg	SWMU336-TW01-00	2/2	380U - 380U	860	NA	2.18E+03 C	N/A	N/A	NO	ND
	105-60-2	Caprolactam	ND	ND	µg/kg	SWMU336-TW01-00	1/2	380U - 380U	860	NA	3.47E+04 C	N/A	N/A	NO	BSL
	86-74-8	Carbazole	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.22E+06 N	N/A	N/A	NO	ND
	218-01-9	Chrysene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.06E+06 N	N/A	N/A	NO	ND
	53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.43E+04 C	N/A	N/A	NO	ND
	132-64-9	Dibenzofuran	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+04 C	N/A	N/A	NO	ND
	84-66-2	Diethyl Phthalate (DEP)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+01 C	N/A	N/A	NO	ND
	131-11-3	Durethyl Phthalate	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	4.89E+06 N	N/A	N/A	NO	ND
	84-74-2	Di-n-butyl Phthalate (DBP)	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.11E+07 N	N/A	N/A	NO	ND
	117-84-0	Di-n-octyl Phthalate	110 J	110 J	µg/kg	SWMU336-TW01-00	0/2	380U - 380U	110	NA	2.44E+05 N	N/A	N/A	NO	BSL
	206-44-0	Fluoranthene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.29E+05 N	N/A	N/A	NO	ND
	86-73-7	Fluorene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.75E+05 N	N/A	N/A	NO	ND
	118-74-1	Hexachlorobenzene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.04E+02 C	N/A	N/A	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	3.47E+04 C	N/A	N/A	NO	ND
	67-72-1	Hexachloroethane	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	193-39-5	Indene(1,2,3-c)pyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	5.12E+05 C	N/A	N/A	NO	ND
	78-59-1	Isophorone	1.1 J	1.1 J	µg/kg	ND	1/3	5.46U - 5.88U	1.1	NA	1.96E+03 N	N/A	N/A	NO	BSL
	91-20-3	Naphthalene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	6.93E+01 C	N/A	N/A	NO	ND
	98-95-3	Nitrobenzene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	9.93E+04 C	N/A	N/A	NO	ND
	621-64-7	n-Nitrosodipropylamine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA		N/A	N/A	NO	ND
	86-30-6	n-Nitrosodiphenylamine	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA		N/A	N/A	NO	ND

TABLE 2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	87-86-5	Semivolatile Organic Compounds (ug/kg) (Cont'													
		Pentachlorophenol	ND	ND	µg/kg	ND	0/2	760U - 800U	ND	NA	2.98E+03 C	N/A	N/A	NO	ND
	85-01-8	Phenanthrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N ⁽¹⁴⁾	N/A	N/A	NO	ND
	108-95-2	Phenol	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	1.83E+06 N	N/A	N/A	NO	ND
	129-00-0	Pyrene	ND	ND	µg/kg	ND	0/2	380U - 400U	ND	NA	2.32E+05 N	N/A	N/A	NO	ND
		Total Metals (mg/kg)													
	7440-38-2	Arsenic	0.3 J	0.81 J	mg/kg	SWMU336-TW05-00	3/7	0.63U - 1U	0.81	1.14	3.90E-01 C	N/A	N/A	NO	BKG
	7440-39-3	Barium	10.4 J	48.2	mg/kg	SWMU336-TW02-00	7/7	(6)	48.2	21.75	5.37E+02 N	N/A	N/A	NO	BSL
	7440-43-9	Cadmium	0.15 J	4.4	mg/kg	SWMU336-TW02-00	5/7	0.05U - 0.09U	4.4	0.02	3.70E+00 N	N/A	N/A	NO	BSL
	7440-47-3	Chromium	10.8	15.3	mg/kg	SWMU336-TW02-00	3/7	0.14U - 0.14U	15.3	12.68	2.11E+02 C	N/A	N/A	NO	BSL
	7439-92-1	Lead	6	18.9 J	mg/kg	SWMU336-TW01-00	7/7	(6)	18.9	16.73	4.00E+02 N	N/A	N/A	NO	BSL
	7439-97-6	Mercury	0.06	0.06	mg/kg	SWMU336-TW01-00	2/7	0.07U - 0.12U	0.06	0.06	2.35E+00 N	N/A	N/A	NO	BSL
	7782-49-2	Selenium	0.62	0.62	mg/kg	SWMU336-TW02-00	1/7	0.55U - 0.71U	0.62	0.81	3.91E+01 N	N/A	N/A	NO	BSL
	7440-22-4	Silver	ND	ND	mg/kg	ND	0/7	0.11U - 0.24U	ND	0.12	3.91E+01 N	N/A	N/A	NO	ND

- (1) J - Analyte present - Reported value is estimated
U - Not detected
JJ - Reported quantitation limit is qualified as estimated

Definitions: N/A = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

- (2) Maximum concentration used for screening
(3) MCB Camp Lejeune Base Background Study, Final (Baker, 2001): 2 * Mean (1/2 nondetects) - AOC 2
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Region IX Residential Soil COC Screening Value (derived from USEPA Region IX PRG Table - October, 2004)
(5) Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Background Levels (BKG)
Below Screening Level (BSL)

C = Carcinogenic mg/kg = milligrams per kilogram
N = Non-Carcinogenic ug/kg = microgram per kilogram

- (6) No detection limits given; analyte detected in every sample.
(7) Screening level for 1,2,4-Trichlorobenzene
(8) Screening value for 1,2-dichloroethene (cis) used as a surrogate.
(9) Screening value for 1,3-dichloropropene (total) used as a surrogate.
(10) Screening level for Isopropylbenzene
(11) Screening value for xylenes (total).
(12) Screening value for naphthalene used as a surrogate
(13) Screening value for acenaphthene used as a surrogate.
(14) Screening value for pyrene used as a surrogate.

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	630-20-6	Volatile Organic Compounds (ug/kg)	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	3.19E+03 C	N/A	N/A	NO	ND
	71-55-6	1,1,1,2-Tetrachloroethane	5 J	5 J	ug/kg	ND	1/14	1.11U - 14U	5	NA	1.98E+05 N	N/A	N/A	NO	BSL
	79-34-5	1,1,1,2,2-Tetrachloroethane (TCA)	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	4.08E+02 C	N/A	N/A	NO	ND
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	ND	ND	ug/kg	ND	0/6	6U - 14U	ND	NA	2.09E+06 N	N/A	N/A	NO	ND
	79-00-5	1,1,2-Trichloroethane	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	7.29E+02 C	N/A	N/A	NO	ND
	75-34-3	1,1-Dichloroethane	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	5.06E+04 N	N/A	N/A	NO	ND
	75-35-4	1,1-Dichloroethene	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	1.24E+04 N	N/A	N/A	NO	ND
	563-58-6	1,1-Dichloropropene	ND	ND	ug/kg	ND	0/8	1.11U - 1.28U	ND	NA	N/A	N/A	N/A	NO	ND
	87-61-6	1,2,3-Trichlorobenzene	0.65 J	1.2 J	ug/kg	SWMU336-SB05-02	2/8	5.54U - 6.41U	1.2	NA	6.22E+03 N ⁽¹⁾	N/A	N/A	NO	BSL
	96-18-4	1,2,3-Trichloropropane	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	3.40E+01 C	N/A	N/A	NO	ND
	120-82-1	1,2,4-Trichlorobenzene	0.67 J	1 J	ug/kg	SWMU336-SB05-02	2/14	5.54U - 14U	1	NA	6.22E+03 N	N/A	N/A	NO	BSL
	95-63-6	1,2,4-Trimethylbenzene	1.7 J	170	ug/kg	SWMU336-SB05-01	2/8	2.33U - 2.56U	170	NA	5.16E+03 N	N/A	N/A	NO	BSL
	96-12-8	1,2-Dibromo-3-chloropropane (DBP)	ND	ND	ug/kg	ND	0/11	5.54U - 11U	ND	NA	4.60E+02 C	N/A	N/A	NO	ND
	106-93-4	1,2-Dibromoethane (EDB)	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	3.20E+01 C	N/A	N/A	NO	ND
	95-50-1	1,2-Dichlorobenzene (o-)	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	1.10E+05 N	N/A	N/A	NO	ND
	107-06-2	1,2-Dichloroethane	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	2.78E+02 C	N/A	N/A	NO	ND
	156-59-2	1,2-Dichloroethene (cis)	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	4.29E+03 N	N/A	N/A	NO	ND
	540-59-0	1,2-Dichloroethene (total)	ND	ND	ug/kg	ND	0/1	11U - 11U	ND	NA	4.29E+03 N ⁽¹⁾	N/A	N/A	NO	ND
	156-60-5	1,2-Dichloroethene (trans)	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	6.95E+03 N	N/A	N/A	NO	ND
	78-87-5	1,2-Dichloropropane	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	3.42E+02 C	N/A	N/A	NO	ND
	108-67-8	1,3,5-Trimethylbenzene	1.1 J	130	ug/kg	SWMU336-SB05-01	2/8	2.33U - 2.56U	130	NA	2.13E+03 N	N/A	N/A	NO	BSL
	541-73-1	1,3-Dichlorobenzene (m-)	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	5.31E+04 N	N/A	N/A	NO	ND
	142-28-9	1,3-Dichloropropane	ND	ND	ug/kg	ND	0/8	1.11U - 1.28U	ND	NA	1.05E+04 N	N/A	N/A	NO	ND
	10061-01-5	1,3-Dichloropropene (cis)	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	10061-02-6	1,3-Dichloropropene (trans)	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	7.77E+02 C ⁽¹⁾	N/A	N/A	NO	ND
	106-46-7	1,4-Dichlorobenzene (p-)	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	3.45E+03 C	N/A	N/A	NO	ND
	594-20-7	2,2-Dichloropropane	ND	ND	ug/kg	ND	0/8	1.11U - 1.28U	ND	NA	N/A	N/A	N/A	NO	ND
	78-93-3	2-Butanone (MEK)	4 J	4 J	ug/kg	SWMU336-SB04-02	1/6	12U - 16U	4	NA	2.23E+06 N	N/A	N/A	NO	BSL
	95-49-8	2-Chlorotoluene	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	1.58E+04 N	N/A	N/A	NO	ND
	591-78-6	2-Hexanone (MBK)	ND	ND	ug/kg	ND	0/6	11U - 16U	ND	NA	N/A	N/A	N/A	NO	ND
	106-43-4	4-Chlorotoluene	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	N/A	N/A	N/A	NO	ND
	99-87-6	4-Isopropyltoluene	32	32	ug/kg	SWMU336-SB05-01	1/8	2.33U - 2.56U	32	NA	5.72E+04 N ⁽¹⁾⁽¹⁾	N/A	N/A	NO	BSL
	108-10-1	4-Methyl-2-pentanone (MIBK)	3 J	3 J	ug/kg	SWMU336-SB04-02	1/6	12U - 16U	3	NA	5.28E+05 N	N/A	N/A	NO	BSL
	67-64-1	Acetone	6 J	31	ug/kg	SWMU336-SB04-02	2/6	12U - 16U	31	NA	1.41E+06 N	N/A	N/A	NO	BSL
	71-43-2	Benzene	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	6.43E+02 C	N/A	N/A	NO	ND
	108-86-1	Bromobenzene	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	2.78E+03 N	N/A	N/A	NO	ND
	74-97-5	Bromochloromethane	ND	ND	ug/kg	ND	0/8	2.22U - 2.56U	ND	NA	N/A	N/A	N/A	NO	ND
	75-27-4	Bromodichloromethane	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	8.24E+02 C	N/A	N/A	NO	ND
	75-25-2	Bromoform	ND	ND	ug/kg	ND	0/14	2.22U - 14U	ND	NA	6.16E+04 C	N/A	N/A	NO	ND
	74-83-9	Bromomethane	ND	ND	ug/kg	ND	0/14	5.54U - 14U	ND	NA	3.90E+02 N	N/A	N/A	NO	ND
	135-98-8	Butylbenzene, sec-	25	25	ug/kg	SWMU336-SB05-01	1/8	2.33U - 2.56U	25	NA	4.46E+04 N	N/A	N/A	NO	BSL
	98-06-6	Butylbenzene, tert-	8.4	8.4	ug/kg	SWMU336-SB05-01	1/8	2.33U - 2.56U	8.4	NA	5.26E+04 N	N/A	N/A	NO	BSL
	75-15-0	Carbon Disulfide	1 J	1 J	ug/kg	SWMU336-SB04-02	1/6	6U - 14U	1	NA	3.55E+04 N	N/A	N/A	NO	BSL
	56-23-5	Carbon Tetrachloride	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	2.51E+02 C	N/A	N/A	NO	ND
	108-90-7	Chlorobenzene	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	1.51E+04 N	N/A	N/A	NO	ND
	75-00-3	Chloroethane	ND	ND	ug/kg	ND	0/14	5.54U - 14U	ND	NA	3.03E+03 C	N/A	N/A	NO	ND
	67-66-3	Chloroform	ND	ND	ug/kg	ND	0/14	1.11U - 14U	ND	NA	2.21E+02 C	N/A	N/A	NO	ND
	74-87-3	Chloromethane	ND	ND	ug/kg	ND	0/14	5.54U - 14U	ND	NA	4.69E+03 N	N/A	N/A	NO	ND
	110-82-7	Cyclohexane	ND	ND	ug/kg	ND	0/6	6U - 14U	ND	NA	2.84E+05 N	N/A	N/A	NO	ND

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	124-48-1	Volatile Organic Compounds (ug/kg) (Cont)	ND	ND	µg/kg	ND	0/14	2.22U - 14U	ND	NA	1.11E+03 C	N/A	N/A	NO	ND
	74-95-3	Dibromochloromethane	ND	ND	µg/kg	ND	0/8	2.22U - 2.56U	ND	NA	6.69E+03 N	N/A	N/A	NO	ND
	75-71-8	Dibromomethane	ND	ND	µg/kg	ND	0/14	5.54U - 14U	ND	NA	9.39E+03 N	N/A	N/A	NO	ND
	100-41-4	Dichlorodifluoromethane	1.8 J	1.8 J	µg/kg	SWMU336-SB05-01	1/14	1.17U - 14U	1.8	NA	1.86E+05 N	N/A	N/A	NO	BSL
	87-68-3	Ethylbenzene	ND	ND	µg/kg	ND	0/8	5.54U - 6.41U	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	98-82-8	Hexachlorobutadiene	7.9	7.9	µg/kg	SWMU336-SB05-01	1/14	2.33U - 14U	7.9	NA	5.72E+04 N	N/A	N/A	NO	BSL
	79-20-9	Isopropylbenzene (Cumene)	15	15	µg/kg	SWMU336-SB04-02	1/6	6U - 14U	15	NA	2.21E+06 N	N/A	N/A	NO	BSL
	108-87-2	Methyl Acetate	ND	ND	µg/kg	ND	0/6	6U - 14U	ND	NA	2.59E+05 N	N/A	N/A	NO	ND
	1634-04-4	Methyl Cyclohexane	ND	ND	µg/kg	ND	0/6	6U - 14U	ND	NA	3.20E+04 C	N/A	N/A	NO	ND
	75-09-2	Methyl Tert-Butyl Ether (MTBE)	9	41	µg/kg	SWMU336-TW01-04	2/14	5.54U - 20U	41	NA	9.11E+03 C	N/A	N/A	NO	BSL
	91-20-3	Methylene Chloride	1.4 J	3.8 J	µg/kg	SWMU336-SB04-02	2/8	5.54U - 6.41U	3.8	NA	5.59E+03 N	N/A	N/A	NO	BSL
	104-51-8	Naphthalene	0.59 J	48	µg/kg	SWMU336-SB05-01	2/8	2.33U - 2.56U	48	NA	5.79E+04 N	N/A	N/A	NO	BSL
	103-65-1	n-Butylbenzene	17	17	µg/kg	SWMU336-SB05-01	1/8	2.33U - 2.56U	17	NA	5.79E+04 N	N/A	N/A	NO	BSL
	100-42-5	n-Propylbenzene	ND	ND	µg/kg	ND	0/14	1.11U - 14U	ND	NA	4.38E+05 N	N/A	N/A	NO	ND
	127-18-4	Styrene (Ethenylbenzene)	7	7	µg/kg	SWMU336-TW01-04	1/14	1.11U - 14U	7	NA	4.84E+02 C	N/A	N/A	NO	BSL
	108-88-3	Tetrachloroethene (PCE)	0.63 J	2 J	µg/kg	SWMU336-TW02-04	2/14	1.17U - 14U	2	NA	6.56E+04 N	N/A	N/A	NO	BSL
	79-01-6	Toluene	ND	ND	µg/kg	ND	0/14	1.11U - 14U	ND	NA	5.30E+01 C	N/A	N/A	NO	ND
	75-69-4	Trichloroethene (TCE)	2 J	2 J	µg/kg	SWMU336-TW02-04, SWMU336-SB04-02	2/14	5.54U - 14U	2	NA	3.86E+04 N	N/A	N/A	NO	BSL
	75-01-4	Trichlorofluoromethane	ND	ND	µg/kg	ND	0/14	2.22U - 14U	ND	NA	7.91E+01 C	N/A	N/A	NO	ND
	000000-01-4	Vinyl Chloride	5.8	5.8	µg/kg	SWMU336-SB05-01	1/12	2.33U - 14U	5.8	NA	2.71E+04 N ⁽¹⁾	N/A	N/A	NO	BSL
	95-47-6	Xylene, m/p-	4.5	4.5	µg/kg	SWMU336-SB05-01	1/12	1.17U - 14U	4.5	NA	2.71E+04 N ⁽¹⁾	N/A	N/A	NO	BSL
	1330-20-7	Xylene, o-	ND	ND	µg/kg	ND	0/3	11U - 19U	ND	NA	2.71E+04 N	N/A	N/A	NO	ND
	92-52-4	Xylenes, total	ND	ND	µg/kg	ND	0/3	11U - 19U	ND	NA	2.71E+04 N	N/A	N/A	NO	ND
	108-60-1	Semivolatile Organic Compounds (ug/kg)	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	3.01E+05 N	N/A	N/A	NO	ND
	95-95-4	1,1'-Biphenyl	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	2.88E+03 C	N/A	N/A	NO	ND
	88-06-2	2,2'-Oxybis[1-chloropropane]	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	120-83-2	2,4,5-Trichlorophenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	105-67-9	2,4,6-Trichlorophenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	51-28-5	2,4-Dichlorophenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	1.22E+05 N	N/A	N/A	NO	ND
	121-14-2	2,4-Dimethylphenol	ND	ND	µg/kg	ND	0/2	2100U - 2200U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	606-20-2	2,4-Dinitrophenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	1.22E+04 N	N/A	N/A	NO	ND
	91-58-7	2,4-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	6.11E+03 N	N/A	N/A	NO	ND
	95-57-8	2,6-Dinitrotoluene	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	4.94E+05 N	N/A	N/A	NO	ND
	91-57-6	2-Chloronaphthalene	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	6.34E+03 N	N/A	N/A	NO	ND
	95-48-7	2-Chlorophenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	5.59E+03 N ⁽¹⁾	N/A	N/A	NO	ND
	88-74-4	2-Methylnaphthalene	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	3.06E+05 N	N/A	N/A	NO	ND
	88-75-5	2-Methylphenol (o-Cresol)	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	1.83E+04 N	N/A	N/A	NO	ND
	91-94-1	2-Nitroaniline	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	N/A	N/A	N/A	NO	ND
	99-09-2	2-Nitrophenol	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	1.08E+03 C	N/A	N/A	NO	ND
	534-52-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	1.83E+03 N	N/A	N/A	NO	ND
	101-55-3	3-Nitroaniline	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	6.11E+02 N	N/A	N/A	NO	ND
	59-50-7	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	N/A	N/A	N/A	NO	ND
	106-47-8	4-Bromophenyl-phenylether	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	N/A	N/A	N/A	NO	ND
	7005-72-3	4-Chloro-3-methylphenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	2.44E+04 N	N/A	N/A	NO	ND
	106-44-5	4-Chloroaniline	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	N/A	N/A	N/A	NO	ND
	100-01-6	4-Chlorophenyl-phenylether	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	3.06E+04 N	N/A	N/A	NO	ND
	100-02-7	4-Methylphenol (p-Cresol)	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	2.32E+04 C	N/A	N/A	NO	ND
		4-Nitroaniline	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	N/A	N/A	N/A	NO	ND
		4-Nitrophenol	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	N/A	N/A	N/A	NO	ND

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil		Semivolatile Organic Compounds (µg/kg) (Cont)													
	83-32-9	Acenaphthene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.68E+05 N	N/A	N/A	NO	ND
	208-96-8	Acenaphthylene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.68E+05 N ⁽¹²⁾	N/A	N/A	NO	ND
	98-86-2	Acetophenone	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	N/A	N/A	N/A	NO	ND
	120-12-7	Anthracene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.19E+06 N	N/A	N/A	NO	ND
	1912-24-9	Atrazine	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.19E+03 C	N/A	N/A	NO	ND
	100-52-7	Benzaldehyde	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	56-55-3	Benzo(a)anthracene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	50-32-8	Benzo(a)pyrene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+01 C	N/A	N/A	NO	ND
	205-99-2	Benzo(b)fluoranthene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.32E+05 N ⁽¹⁴⁾	N/A	N/A	NO	ND
	207-08-9	Benzo(k)fluoranthene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+03 C	N/A	N/A	NO	ND
	111-91-1	Bis(2-chloroethoxy)methane	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	N/A	N/A	N/A	NO	ND
	111-44-4	Bis(2-chloroethyl)ether	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.18E+02 C	N/A	N/A	NO	ND
	117-81-7	Bis(2-ethylhexyl) Phthalate (BEHP)	95 J	95 J	µg/kg	SWMU336-TW02-04	1/2	430UJ - 430UJ	95	NA	3.47E+04 C	N/A	N/A	NO	BSL
	85-68-7	Butyl Benzyl Phthalate	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	1.22E+06 N	N/A	N/A	NO	ND
	105-60-2	Caprolactam	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.06E+06 N	N/A	N/A	NO	ND
	86-74-8	Carbazole	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.43E+04 C	N/A	N/A	NO	ND
	218-01-9	Chrysene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+04 C	N/A	N/A	NO	ND
	53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+01 C	N/A	N/A	NO	ND
	132-64-9	Dibenzofuran	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	1.45E+04 N	N/A	N/A	NO	ND
	84-66-2	Diethyl Phthalate (DEP)	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	4.89E+06 N	N/A	N/A	NO	ND
	131-11-3	Dimethyl Phthalate	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.11E+07 N	N/A	N/A	NO	ND
	84-74-2	Di-n-butyl Phthalate (DBP)	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.11E+05 N	N/A	N/A	NO	ND
	117-84-0	Di-n-octyl Phthalate	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.44E+05 N	N/A	N/A	NO	ND
	206-44-0	Fluoranthene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.29E+05 N	N/A	N/A	NO	ND
	86-73-7	Fluorene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.75E+05 N	N/A	N/A	NO	ND
	118-74-1	Hexachlorobenzene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.04E+02 C	N/A	N/A	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	ND	0/8	5.54U - 6.41U	ND	NA	6.24E+03 C	N/A	N/A	NO	ND
	77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.65E+04 N	N/A	N/A	NO	ND
	67-72-1	Hexachloroethane	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	3.47E+04 C	N/A	N/A	NO	ND
	193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.21E+02 C	N/A	N/A	NO	ND
	78-59-1	Isophorone	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	5.12E+05 C	N/A	N/A	NO	ND
	91-20-3	Naphthalene	1.4 J	3.8 J	µg/kg	SWMU336-SB04-02	2/8	5.54U - 6.41U	3.8	NA	5.59E+03 N	N/A	N/A	NO	BSL
	98-95-3	Nitrobenzene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	1.96E+03 N	N/A	N/A	NO	ND
	621-64-7	n-Nitrosodi-n-propylamine	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	6.95E+01 C	N/A	N/A	NO	ND
	86-30-6	n-Nitrosodiphenylamine	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	9.93E+04 C	N/A	N/A	NO	ND
	87-86-5	Pentachlorophenol	ND	ND	µg/kg	ND	0/2	800U - 870U	ND	NA	2.98E+03 C	N/A	N/A	NO	ND
	85-01-8	Phenanthrene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.32E+05 N ⁽¹⁴⁾	N/A	N/A	NO	ND
	108-95-2	Phenol	ND	ND	µg/kg	ND	0/2	400U - 430U	ND	NA	1.83E+06 N	N/A	N/A	NO	ND
	129-00-0	Pyrene	ND	ND	µg/kg	ND	0/2	400U - 430UJ	ND	NA	2.32E+05 N	N/A	N/A	NO	ND

TABLE 2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	7440-38-2	Metals (mg/kg)	ND	ND	mg/kg	ND	0/8	0.28U - 1.2U	ND	2.69	3.90E+01 C	N/A	N/A	NO	ND
	7440-39-3	Arsenic	7.1	17.7 J	mg/kg	SWMU336-SB04-02	8/8	(6)	17.7	34.7	5.37E+02 N	N/A	N/A	NO	BSL
	7440-43-9	Barium	0.12 J	0.12 J	mg/kg	SWMU336-TW05-04	1/8	0.04U - 0.11U	0.12	ND	3.70E+00 N	N/A	N/A	NO	BSL
	7440-47-3	Cadmium	6.2	19.8	mg/kg	SWMU336-SB05-02	5/8	0.15U - 0.16U	19.8	24.0	2.11E+02 C	N/A	N/A	NO	BSL
	7439-92-1	Chromium	4.5 J	10	mg/kg	SWMU336-SB04-02	8/8	(6)	10	14.1	4.00E+02 N	N/A	N/A	NO	BSL
	7439-97-6	Lead	0.03 J	0.03 J	mg/kg	SWMU336-TW01-04, SWMU336-TW02-04	2/8	0.04U - 0.12U	0.03	0.0472	2.35E+00 N	N/A	N/A	NO	BSL
	7782-49-2	Mercury	0.77 J	0.77 J	mg/kg	SWMU336-TW03-04	1/8	0.54U - 0.81UJ	0.77	0.807	3.91E+01 N	N/A	N/A	NO	BSL
	7440-22-4	Selenium	ND	ND	mg/kg	ND	0/8	0.11U - 0.27UJ	ND	0.182	3.91E+01 N	N/A	N/A	NO	ND
		Silver	ND	ND	mg/kg										

- (1) J - Analyte present - Reported value is estimated
U - Not detected
UJ - Reported quantitation limit is qualified as estim

Definitions: N/A = Not Applicable
ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

- (2) Maximum concentration used for screening
(3) MCB Camp Lejeune Base Background Study, Final (Baker, 2001): 2 * Mean (1/2 nondetects) - AOC 2
(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals
USEPA Region IX Residential Soil COC Screening Value (derived from USEPA Region IX PRG Table - October, 2004)
(5) Rationale Codes

C = Carcinogenic mg/kg = milligrams per kilogram
N = Non-Carcinogenic ug/kg = microgram per kilogram

Selection Reason: Below Screening Level (BSL)

- (6) No detection limits given; analyte detected in every sample.
(7) Screening level for 1,2,4-Trichlorobenzene
(8) Screening value for 1,2-dichloroethene (cis) used as a surrogate.
(9) Screening value for 1,3-dichloropropene (total) used as a surrogate.
(10) Screening level for Isopropylbenzene
(11) Screening value for xylenes (total).
(12) Screening value for naphthalene used as a surrogate
(13) Screening value for acenaphthene used as a surrogate.
(14) Screening value for pyrene used as a surrogate.

TABLE 2.4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater		VOLATILES (ug/L)													
	630-20-6	1,1,1,2-Tetrachloroethane	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	4.32E-01 C	N/A	N/A	NO	ND
	71-55-6	1,1,1-Trichloroethane (TCA)	1.4 J	19	µg/L	SWMU336-GW01	3/17	1U - 10U	19	NA	3.17E+02 N	2.00E+02	MCL	NO	BSL
	79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	5.53E-02 C	N/A	N/A	NO	ND
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1 J	1 J	µg/L	SWMU336-GW02	1/8	5U - 10U	1	NA	5.92E+03 N	N/A	N/A	NO	BSL
	79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	2.00E-01 C	5.00E+00	MCL	NO	ND
	75-34-3	1,1-Dichloroethane	1.4 J	21	µg/L	SWMU336-GW01	2/17	1U - 10U	21	NA	8.11E+01 N	N/A	N/A	NO	BSL
	75-35-4	1,1-Dichloroethene	2 J	2 J	µg/L	SWMU336-GW01	1/17	1U - 10U	2	NA	3.39E+01 N	7.00E+00	MCL	NO	BSL
	563-58-6	1,1-Dichloropropene	ND	ND	µg/L	ND	0/10	1U - 1U	ND	NA	N/A	N/A	N/A	NO	ND
	87-61-6	1,2,3-Trichlorobenzene	0.52 J	0.73 J	µg/L	SWMU336-GW08	2/10	5U - 5U	0.73	NA	7.16E-01 N ⁽¹⁾	7.00E+01	MCL ⁽¹⁾	YES	ASL
	96-18-4	1,2,3-Trichloropropane	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	5.60E-03 C	N/A	N/A	NO	ND
	120-82-1	1,2,4-Trichlorobenzene	0.66 J	0.66 J	µg/L	SWMU336-GW08	1/17	5U - 10U	0.66	NA	7.16E-01 N	7.00E+01	MCL	NO	BSL
	95-63-6	1,2,4-Trimethylbenzene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	1.23E+00 N	N/A	N/A	NO	ND
	95-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	4.76E-02 C	2.00E-01	MCL	NO	ND
	106-93-4	1,2-Dibromoethane (EDB)	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	5.60E-03 C	5.00E-02	MCL	NO	ND
	95-50-1	1,2-Dichlorobenzene (o-)	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	3.70E+01 N	6.00E+02	MCL	NO	ND
	107-06-2	1,2-Dichloroethane	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.23E-01 C	5.00E+00	MCL	NO	ND
	156-59-2	1,2-Dichloroethene (cis)	0.8 J	0.8 J	µg/L	SWMU336-GW01	1/17	1U - 10U	0.8	NA	6.08E+00 N	7.00E+01	MCL	NO	BSL
	540-59-0	1,2-Dichloroethene (total)	ND	ND	µg/L	ND	0/2	10U - 10U	ND	NA	6.08E+00 N ⁽¹⁾	7.00E+01	MCL ⁽¹⁾	NO	ND
	156-60-5	1,2-Dichloroethene (trans)	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.22E+01 N	1.00E+02	MCL	NO	ND
	78-87-5	1,2-Dichloropropane	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.65E-01 C	5.00E+00	MCL	NO	ND
	108-67-8	1,3,5-Trimethylbenzene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	1.23E+00 N	N/A	N/A	NO	ND
	541-73-1	1,3-Dichlorobenzene (m-)	0.27 J	0.27 J	µg/L	SWMU336-GW09-01	1/17	2U - 10U	0.27	NA	1.83E+01 N	N/A	N/A	NO	BSL
	142-28-9	1,3-Dichloropropane	ND	ND	µg/L	ND	0/10	1U - 1U	ND	NA	1.22E+01 N	N/A	N/A	NO	ND
	10061-01-5	1,3-Dichloropropene (cis)	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	3.95E-01 C ⁽¹⁾	N/A	N/A	NO	ND
	10061-02-6	1,3-Dichloropropene (trans)	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	3.95E-01 C ⁽¹⁾	N/A	N/A	NO	ND
	106-46-7	1,4-Dichlorobenzene (p-)	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	5.02E-01 C	7.50E+01	MCL	NO	ND
	594-20-7	2,2-Dichloropropane	ND	ND	µg/L	ND	0/10	1U - 1U	ND	NA	N/A	N/A	N/A	NO	ND
	78-93-3	2-Butanone (MEK)	ND	ND	µg/L	ND	0/8	10U - 13U	ND	NA	6.97E+02 N	N/A	N/A	NO	ND
	95-49-8	2-Chlorotoluene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	1.22E+01 N	N/A	N/A	NO	ND
	591-78-6	2-Hexanone (MBK)	ND	ND	µg/L	ND	0/8	10U - 13U	ND	NA	N/A	N/A	N/A	NO	ND
	106-43-4	4-Chlorotoluene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	99-87-6	4-Isopropyltoluene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	6.58E+01 N ⁽¹⁾	N/A	N/A	NO	ND
	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	ND	µg/L	ND	0/8	10U - 13U	ND	NA	1.99E+02 N	N/A	N/A	NO	ND
	67-64-1	Acetone	ND	ND	µg/L	ND	0/8	6U - 10U	ND	NA	5.48E+02 N	N/A	N/A	NO	ND
	71-43-2	Benzene	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	3.54E-01 C	5.00E+00	MCL	NO	ND
	108-86-1	Bromobenzene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	2.03E+00 N	N/A	N/A	NO	ND
	74-97-5	Bromochloromethane	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	75-27-4	Bromodichloromethane	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	1.81E-01 C	8.00E+01	MCL	NO	ND
	75-25-2	Bromoform	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	8.51E+00 C	8.00E+01	MCL	NO	ND
	74-83-9	Bromomethane	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	8.66E-01 N	N/A	N/A	NO	ND
	135-98-8	Butylbenzene, sec-	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	2.43E+01 N	N/A	N/A	NO	ND
	98-06-6	Butylbenzene, tert-	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	2.43E+01 N	N/A	N/A	NO	ND
	75-15-0	Carbon Disulfide	ND	ND	µg/L	ND	0/8	5U - 10U	ND	NA	1.04E+02 N	N/A	N/A	NO	ND
	56-23-5	Carbon Tetrachloride	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.71E-01 C	5.00E+00	MCL	NO	ND
	108-90-7	Chlorobenzene	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.06E+01 N	1.00E+02	MCL	NO	ND
	75-00-3	Chloroethane	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	4.64E+00 C	N/A	N/A	NO	ND
	67-66-3	Chloroform	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.66E-01 C	8.00E+01	MCL	NO	ND

TABLE 2.4
OCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CFO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
		VOLATILES (ug/L)													
	74-87-3	Chloromethane	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	1.58E+01 N	N/A	N/A	NO	ND
	110-82-7	Cyclohexane	ND	ND	ug/L	ND	0/8	5U - 10U	ND	NA	1.03E+03 N	N/A	N/A	NO	ND
	124-48-1	Dibromochloromethane	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	1.33E-01 C	8.00E+01	MCL	NO	ND
	74-95-3	Dibromomethane	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	6.08E+00 N	N/A	N/A	NO	ND
	75-71-8	Dichlorodifluoromethane	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	3.95E+01 N	N/A	N/A	NO	ND
	100-41-4	Ethylbenzene	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	1.34E+02 N	7.00E+02	MCL	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	ug/L	ND	0/10	5U - 5U	ND	NA	8.62E-01 C	N/A	N/A	NO	ND
	98-82-8	Isopropylbenzene (Cumene)	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	6.58E+01 N	N/A	N/A	NO	ND
	79-20-9	Methyl Acetate	ND	ND	ug/L	ND	0/8	5U - 10U	ND	NA	6.08E+02 N	N/A	N/A	NO	ND
	108-87-2	Methyl Cyclohexane	ND	ND	ug/L	ND	0/8	5U - 10U	ND	NA	5.22E+02 N	N/A	N/A	NO	ND
	1634-04-4	Methyl Tert-Butyl Ether (MTBE)	ND	ND	ug/L	ND	0/8	5U - 10U	ND	NA	1.10E+01 C	N/A	N/A	NO	ND
	75-09-2	Methylene Chloride	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	4.28E+00 C	5.00E+00	MCL	NO	ND
	91-20-3	Naphthalene	0.85 J	5	ug/L	SWMU336-GW08-01	0/10	5U - 5U	5	NA	6.20E-01 N	N/A	N/A	NO	ASL
	104-51-8	n-Butylbenzene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	2.43E+01 N	N/A	N/A	NO	ND
	103-65-1	n-Propylbenzene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	1.64E+02 N	1.00E+02	MCL	NO	ND
	100-42-5	Styrene (Ethylbenzene)	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.04E-01 C	5.00E+00	MCL	NO	ASL
	127-18-4	Tetrachloroethene (PCE)	2.3 J	27	ug/L	SWMU336-GW01	3/17	1U - 10U	3.3	NA	7.23E+01 N	1.00E+03	MCL	NO	BSL
	108-88-3	Toluene	0.33 J	3.3 J	ug/L	SWMU336-TW05	2/17	1U - 10U	ND	NA	2.80E+02 C	5.00E+00	MCL	NO	ND
	79-01-6	Trichloroethene (TCE)	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.29E+02 N	N/A	N/A	NO	ND
	75-01-4	Trichlorofluoromethane	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	1.98E+02 C	2.00E+00	MCL	NO	ND
	75-01-4	Vinyl Chloride	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	2.06E+01 N ⁽¹¹⁾	1.00E+04	MCL ⁽¹¹⁾	NO	BSL
	000000-01-4	Xylene, m/p	0.4 J	1.7 J	ug/L	SWMU336-TW05	2/15	2U - 20U	1.7	NA	2.06E+01 N ⁽¹¹⁾	1.00E+04	MCL ⁽¹¹⁾	NO	BSL
	95-47-6	Xylene, o	0.94 J	0.94 J	ug/L	SWMU336-TW05	1/15	1U - 10U	0.94	NA	2.06E+01 N ⁽¹¹⁾	1.00E+04	MCL ⁽¹¹⁾	NO	BSL
	1330-30-7	Xylenes, total	ND	ND	ug/L	ND	0/4	5U - 10U	ND	NA	2.06E+01 N	1.00E+04	MCL	NO	ND
	7440-38-2	Metals (ug/L)	ND	ND	ug/L	ND	0/6	2.4U - 3.6U	ND	5.8	4.48E-02 C	1.00E+01	MCL	NO	ND
	7440-39-3	Arsenic	10.9 J	161 J	ug/L	SWMU336-TW03	6/6	1U - 1.3U	161	86.2	2.55E+02 N	2.00E+03	MCL	NO	BSL
	7440-43-9	Barium	ND	ND	ug/L	ND	0/6	0.8U - 0.8U	ND	ND	1.82E+00 N	5.00E+00	MCL	NO	BSL
	7440-47-3	Cadmium	0.84 J	2.7	ug/L	SWMU336-GW02	2/6	1.6U - 1.8U	2	3.1	1.09E+01 N ⁽¹²⁾	1.00E+02	MCL	NO	BSL
	7439-92-1	Lead	2.6 J	2.6 J	ug/L	SWMU336-GW02	1/6	0.1U - 0.2U	2.6	2.8	1.50E+01 N ⁽¹²⁾	1.50E+01	MCL ⁽¹²⁾	NO	BSL
	7439-97-6	Mercury	ND	ND	ug/L	ND	0/6	0.1U - 0.2U	ND	ND	1.09E+00 N	2.00E+00	MCL	NO	ND
	7782-49-2	Selenium	ND	ND	ug/L	ND	0/6	2.6U - 4.6U	ND	ND	1.82E+01 N	5.00E+01	MCL	NO	ND
	7440-22-4	Silver	ND	ND	ug/L	ND	0/6	0.9U - 1.7UJ	ND	0.8	1.82E+01 N	1.00E+02	sMCL	NO	ND

(1) J - Analyte present - Reported value is estimated
U - Not detected

(2) Maximum concentration used for screening

(3) MCB Camp Lejeune Base Background Study, Final (Baker, 2001); 2 * Mean (1/2 nondetects) - AOC 2

(4) All non-carcinogenic criteria were divided by 10 to account for potential additive effects of chemicals

(5) Rationale Codes

(6) No detection limits given; analyte detected in every sample.

(7) Screening level for 1,2,4-Trichlorobenzene

(8) Screening value for 1,2-dichloroethene (cis) used as a surrogate.

(9) Screening value for 1,3-dichloropropane (total) used as a surrogate.

(10) Screening level for Isopropylbenzene

(11) Screening value for xylenes (total).

(12) Screening value for chromium VI used.

(13) Action level for lead.

Definitions:

ND = Not Detected

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

MCL = Maximum Contaminant Levels (Winter, 2004)

C = Carcinogenic

N = Non-Carcinogenic

ug/L = microgram per liter

TABLE 2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	630-20-6	VOLATILES (ug/L)	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	71-55-6	1,1,1,2-Tetrachloroethane	1.4 J	19	ug/L	SWMU336-GW01	3/17	1U - 10U	19	NA	2.00E+02	2.00E+02	MCL	NO	BSL
	79-34-5	1,1,1,2,2-Tetrachloroethane	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	N/A	N/A	N/A	NO	ND
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1 J	1 J	ug/L	SWMU336-GW02	1/8	5U - 10U	1	NA	2.10E+05	N/A	N/A	NO	BSL
	79-00-5	1,1,2-Trichloroethane	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	N/A	5.00E+00	MCL	NO	ND
	75-34-3	1,1-Dichloroethane	1.4 J	21	ug/L	SWMU336-GW01	2/17	1U - 10U	21	NA	7.00E+02	N/A	N/A	NO	BSL
	75-35-4	1,1-Dichloroethene	2 J	2 J	ug/L	SWMU336-GW01	1/17	1U - 10U	2	NA	7.00E+00	7.00E+00	MCL	NO	BSL
	563-58-6	1,1-Dichloropropene	ND	ND	ug/L	ND	0/10	1U - 1U	ND	NA	N/A	N/A	N/A	NO	ND
	87-61-6	1,2,3-Trichlorobenzene	0.52 J	0.73 J	ug/L	SWMU336-GW08	2/10	5U - 5U	0.73	NA	N/A	7.00E+01	MCL (1)	NO	NSC
	96-18-4	1,2,3-Trichloropropane	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	5.00E-03	N/A	N/A	NO	ND
	120-82-1	1,2,4-Trichlorobenzene	0.66 J	0.66 J	ug/L	SWMU336-GW08	1/17	5U - 10U	0.66	NA	N/A	7.00E+01	MCL	NO	NSC
	95-63-6	1,2,4-Trimethylbenzene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	3.50E+02	N/A	N/A	NO	ND
	96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	2.50E-02	2.00E-01	MCL	NO	ND
	106-93-4	1,2-Dibromoethane (EDB)	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	4.00E-04	5.00E-02	MCL	NO	ND
	95-50-1	1,2-Dichlorobenzene (o-)	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	6.20E+02	6.00E+02	MCL	NO	ND
	107-06-2	1,2-Dichloroethane	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	3.80E-01	5.00E+00	MCL	NO	ND
	156-59-2	1,2-Dichloroethene (cis)	0.8 J	0.8 J	ug/L	SWMU336-GW01	1/17	1U - 10U	0.8	NA	7.00E+01	7.00E+01	MCL	NO	BSL
	540-59-0	1,2-Dichloroethene (total)	ND	ND	ug/L	ND	0/2	10U - 10U	ND	NA	7.00E+01 (1)	7.00E+01	MCL (1)	NO	ND
	156-60-5	1,2-Dichloroethene (trans)	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	7.00E+01	1.00E+02	MCL	NO	ND
	78-87-5	1,2-Dichloropropane	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	5.60E-01	5.00E+00	MCL	NO	ND
	108-67-8	1,3,5-Trimethylbenzene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	3.50E+02	N/A	N/A	NO	ND
	541-73-1	1,3-Dichlorobenzene (m-)	0.27 J	0.27 J	ug/L	SWMU336-GW09-01	1/17	2U - 10U	0.27	NA	6.20E+02	N/A	N/A	NO	BSL
	142-28-9	1,3-Dichloropropane	ND	ND	ug/L	ND	0/10	1U - 1U	ND	NA	N/A	N/A	N/A	NO	ND
	10061-01-5	1,3-Dichloropropene (cis)	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.90E-01 (1)	N/A	N/A	NO	ND
	10061-02-6	1,3-Dichloropropene (trans)	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.90E-01 (1)	N/A	N/A	NO	ND
	106-46-7	1,4-Dichlorobenzene (p-)	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	7.50E+01	7.50E+01	MCL	NO	ND
	594-20-7	2,2-Dichloropropane	ND	ND	ug/L	ND	0/10	1U - 1U	ND	NA	N/A	N/A	N/A	NO	ND
	78-93-3	2-Butanone (MEK)	ND	ND	ug/L	ND	0/8	10U - 13U	ND	NA	1.70E+02	N/A	N/A	NO	ND
	95-49-8	2-Chlorotoluene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	1.40E+02	N/A	N/A	NO	ND
	591-78-6	2-Hexanone (MBK)	ND	ND	ug/L	ND	0/8	10U - 13U	ND	NA	N/A	N/A	N/A	NO	ND
	106-43-4	4-Chlorotoluene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	1.40E+02 (1)	N/A	N/A	NO	ND
	99-87-6	4-Isopropyltoluene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	ND	ug/L	ND	0/8	10U - 13U	ND	NA	N/A	N/A	N/A	NO	ND
	67-64-1	Acetone	ND	ND	ug/L	ND	0/8	6U - 10U	ND	NA	7.00E+02	N/A	N/A	NO	ND
	71-43-2	Benzene	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.00E+00	5.00E+00	MCL	NO	ND
	108-86-1	Bromobenzene	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	74-97-5	Bromochloromethane	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	75-27-4	Bromodichloromethane	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	5.60E-01	8.00E+01	MCL	NO	ND
	75-25-2	Bromoform	ND	ND	ug/L	ND	0/17	2U - 10U	ND	NA	1.90E-01	8.00E+01	MCL	NO	ND
	74-83-9	Bromomethane	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	N/A	N/A	N/A	NO	ND
	135-98-8	Butylbenzene, sec-	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	7.00E+01	N/A	N/A	NO	ND
	98-06-6	Butylbenzene, tert-	ND	ND	ug/L	ND	0/10	2U - 2U	ND	NA	7.00E+01	N/A	N/A	NO	ND
	75-15-0	Carbon Disulfide	ND	ND	ug/L	ND	0/8	5U - 10U	ND	NA	7.00E+02	N/A	N/A	NO	ND
	56-23-5	Carbon Tetrachloride	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	3.00E-01	5.00E+00	MCL	NO	ND
	108-90-7	Chlorobenzene	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	5.00E+01	1.00E+02	MCL	NO	ND
	75-00-3	Chloroethane	ND	ND	ug/L	ND	0/17	5U - 10U	ND	NA	2.80E+03	N/A	N/A	NO	ND
	67-66-3	Chloroform	ND	ND	ug/L	ND	0/17	1U - 10U	ND	NA	1.90E-01	8.00E+01	MCL	NO	ND

TABLE 2.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
		VOLATILES (ug/L)													
	74-87-3	Chloromethane	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	2.60E+00	N/A	N/A	NO	ND
	110-82-7	Cyclohexane	ND	ND	µg/L	ND	0/8	5U - 10U	ND	NA	N/A	N/A	N/A	NO	ND
	124-48-1	Dibromochloromethane	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	N/A	8.00E+01	MCL	NO	ND
	74-95-3	Dibromomethane	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	N/A	N/A	N/A	NO	ND
	75-71-8	Dichlorodifluoromethane	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	1.40E+03	N/A	N/A	NO	ND
	100-41-4	Ethylbenzene	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	2.90E+01	7.00E+02	MCL	NO	ND
	87-68-3	Hexachlorobutadiene	ND	ND	µg/L	ND	0/10	5U - 5U	ND	NA	N/A	N/A	N/A	NO	ND
	98-82-8	Isopropylbenzene (Cumene)	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	7.00E+01	N/A	N/A	NO	ND
	79-20-9	Methyl Acetate	ND	ND	µg/L	ND	0/8	5U - 10U	ND	NA	N/A	N/A	N/A	NO	ND
	108-87-2	Methyl Cyclohexane	ND	ND	µg/L	ND	0/8	5U - 10U	ND	NA	N/A	N/A	N/A	NO	ND
	1634-04-4	Methyl Tert-Butyl Ether (MTBE)	ND	ND	µg/L	ND	0/8	5U - 10U	ND	NA	2.00E+02	N/A	N/A	NO	ND
	75-09-2	Methylene Chloride	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	5.00E+00	5.00E+00	MCL	NO	ND
	91-20-3	Naphthalene	0.85 J	5	µg/L	SWMU336-GW08-01	4/10	5U - 5U	5	NA	2.10E+01	N/A	N/A	NO	BSL
	104-51-8	n-Butylbenzene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	7.00E+01	N/A	N/A	NO	ND
	103-65-1	n-Propylbenzene	ND	ND	µg/L	ND	0/10	2U - 2U	ND	NA	7.00E+01	N/A	N/A	NO	ND
	100-42-5	Styrene (Ethenylbenzene)	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	1.00E+02	1.00E+02	MCL	NO	ND
	127-18-4	Tetrachloroethene (PCE)	2.3 J	27	µg/L	SWMU336-GW01	3/17	1U - 10U	27	NA	7.00E-01	5.00E+00	MCL	NO	ASL
	108-88-3	Toluene	0.33 J	3.3 J	µg/L	SWMU336-TW05	2/17	1U - 10U	3.3	NA	1.00E+03	1.00E+03	MCL	NO	BSL
	79-01-6	Trichloroethene (TCE)	ND	ND	µg/L	ND	0/17	1U - 10U	ND	NA	2.80E+00	5.00E+00	MCL	NO	ND
	75-69-4	Trichlorofluoromethane	ND	ND	µg/L	ND	0/17	5U - 10U	ND	NA	2.10E+03	N/A	N/A	NO	ND
	75-01-4	Vinyl Chloride	ND	ND	µg/L	ND	0/17	2U - 10U	ND	NA	1.50E-02	2.00E+00	MCL	NO	ND
	000000-01-4	Xylene, m/p-	0.4 J	1.7 J	µg/L	SWMU336-TW05	2/15	2U - 20U	1.7	NA	5.30E+02 ⁽¹¹⁾	1.00E+04	MCL ⁽¹¹⁾	NO	BSL
	95-47-6	Xylene, o-	0.94 J	0.94 J	µg/L	SWMU336-TW05	1/15	1U - 10U	0.94	NA	5.30E+02 ⁽¹¹⁾	1.00E+04	MCL ⁽¹¹⁾	NO	BSL
	1330-20-7	Xylenes, total	ND	ND	µg/L	ND	0/4	5U - 10U	ND	NA	5.30E+02	1.00E+04	MCL	NO	ND
		Metals (ng/L)													
	7440-38-2	Arsenic	ND	ND	µg/L	ND	0/6	2.4U - 3.6U	ND	5.8	1.00E+01	1.00E+01	MCL	NO	ND
	7440-39-3	Barium	10.9 J	161 J	µg/L	SWMU336-TW03	6/6	(6)	161	86.2	2.00E+03	2.00E+03	MCL	NO	BSL
	7440-43-9	Cadmium	ND	ND	µg/L	ND	0/6	1U - 1.3U	ND	ND	5.00E+00	5.00E+00	MCL	NO	ND
	7440-47-3	Chromium	0.84 J	2 J	µg/L	SWMU336-GW02	2/6	0.8U - 0.8U	2	3.1	5.00E+01	1.00E+02	MCL	NO	BSL
	7439-92-1	Lead	2.6 J	2.6 J	µg/L	SWMU336-GW02	1/6	1.6U - 1.8U	2.6	2.8	1.50E+01	1.50E+01	MCL ⁽¹²⁾	NO	BSL
	7439-97-6	Mercury	ND	ND	µg/L	ND	0/6	0.1U - 0.2U	ND	ND	1.10E+00	2.00E+00	MCL	NO	ND
	7782-49-2	Selenium	ND	ND	µg/L	ND	0/6	2.6U - 4.6U	ND	ND	5.00E+01	5.00E+01	MCL	NO	ND
	7440-22-4	Silver	ND	ND	µg/L	ND	0/6	0.9U - 1.7U	ND	0.8	1.80E+01	1.00E+02	MCL	NO	ND

(1) J - Analyte present - Reported value is estimated
U - Not detected

- (2) Maximum concentration used for screening
(3) MCB Camp Lejeune Base Background Study, Final (Baker, 2001): 2 * Mean (1/2 nondetects) - AOC 2
(4) North Carolina Department of Environment and Natural Resources (NC DENR)
Target Groundwater Concentration
(5) Rationale Codes

Selection Reason: No Screening Criteria (NSC)
Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

- (6) No detection limits given; analyte detected in every sample.
(7) Screening level for 1,2,4-Trichlorobenzene
(8) Screening value for 1,2-dichloroethene (cis) used as a surrogate.

- (9) Screening value for 1,3-dichloropropene (total) used as a surrogate.
(10) Screening level for Isopropylbenzene

Definitions: ND = Not Detected
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Maximum Contaminant Levels (Winter, 2004)

C = Carcinogenic ug/L = microgram per liter
N = Non-Carcinogenic

- (11) Screening value for xylenes (total).
(12) Action level for lead.

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL Test)
Surface Soil	Cadmium	mg/kg	1.19	5.15 (G)	4.4	5.15	mg/kg	95% UCL (G)	95% Approximate Gamma UCL

EPC = Exposure Point Concentration

UCL = Upper Confidence Level

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

(1) Distribution and 95% UCL were calculated by ProUCL and are indicated as follows:

(G) - Gamma distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL).

TABLE 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future Medium: Surface Soil Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale (ProUCL Test)
Surface Soil	Cadmium	mg/kg	1.03	4.16 (G)	4.4	4.16	mg/kg	95% UCL (G)	95% Approximate Gamma UCL

EPC = Exposure Point Concentration

UCL = Upper Confidence Level

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

(1) Distribution and 95% UCL were calculated by ProUCL and are indicated as follows:

(G) - Gamma distribution and 95% UCL

(2) Exposure point concentration statistic will be the 95% UCL (as calculated by ProUCL).

TABLE 3.3.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	1,2,3-Trichlorobenzene	µg/L	2.13	3.29 (NP)	0.73 J	0.00073	mg/L	Max	Conservative Estimate
	Naphthalene	µg/L	2.33	3.32 (G)	5	0.005	mg/L	Max	Conservative Estimate
	Tetrachloroethene (PCE)	µg/L	4.08	22.5 (NP)	27	0.027	mg/L	Max	Conservative Estimate

EPC = Exposure Point Concentration

UCL = Upper Confidence Level

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration.

(1) Distribution and 95% UCL were calculated by ProUCL and are indicated as follows:

(NP) - Non-parametric distribution and 95% UCL

(G) - Gamma distribution and 95% UCL

(2) Conservative estimate using the maximum concentration

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091):
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Ingestion	Current Military Base Personnel	Adult	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	Chronic Daily Intake (CDI) Equations CDI (mg/kg-day) = $C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/A1$
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge	
				EF	Exposure Frequency	250	days/year	USEPA, 2001	
				ED	Exposure Duration	4	years	Sid Tour of Duty	
	Future Trespassers	Adolescent	Surface Soil	BW	Body Weight	70	kg	USEPA, 1997	CDI (mg/kg-day) = $C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/A1$
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	1,460	days	USEPA, 1989	
				C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
	Future Residents	Adult	Surface Soil	FI	Fraction Ingested from Source	1	NA	Prof Judge	CDI (mg/kg-day) = $C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/A1$
				EF	Exposure Frequency	52	days/year	Prof Judge	
				ED	Exposure Duration	10	years	USEPA, 2000	
				BW	Body Weight	45	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,650	days	USEPA, 1989	
		Young Child	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	CDI (mg/kg-day) = $C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/A1$
				IR-S	Ingestion Rate of Soil	200	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	6	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091),
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Ingestion (Cont)	Future Construction Workers	Adult	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<p>Chronic Daily Intake (CDI) Equations</p> $CDI (mg/kg-day) = C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/AT$
				IR-S	Ingestion Rate of Soil	480	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge	
				EF	Exposure Frequency	250	days/year	USEPA, 2001	
				ED	Exposure Duration	1	years	Prof Judge	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
Dermal	Current Military Base Personnel	Adult	Surface Soil	AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
				C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<p>Dermally Adjusted Dose (DAD) Equations</p> $DAD (mg/kg-day) = C \times CF \times SA \times AF \times ABS \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm ² /day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm ²	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	250	days/year	USEPA, 2001	
				ED	Exposure Duration	4	years	Sold Tour of Duty	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	1,460	days	USEPA, 1989	
	Future Trespassers	Adolescent	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<p>DAD (mg/kg-day) =</p> $C \times CF \times SA \times AF \times ABS \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	5,300	cm ² /day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm ²	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	52	days/year	Prof Judge	
				ED	Exposure Duration	10	years	USEPA, 2000	
				BW	Body Weight	45	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,650	days	USEPA, 1989	
	Future Residents	Adult	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<p>DAD (mg/kg-day) =</p> $C \times CF \times SA \times AF \times ABS \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	5,700	cm ² /day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.07	mg/cm ²	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	24	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Dermal (Cont)	Future Residents	Young Child	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> DAD (mg/kg-day) = $C \times CF \times SA \times AF \times ABS \times EF \times ED \div 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	2,800	cm2/day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	6	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
	Future Construction Workers	Adult	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	DAD (mg/kg-day) = $C \times CF \times SA \times AF \times ABS \times EF \times ED \div 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	3,300	cm2/day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	250	days/year	USEPA, 2001	
				ED	Exposure Duration	1	years	Prof Judge	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.1

Prof Judge - Professional Judgment

Std Tour of Duty - Standard Tour of Duty

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/001

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

USEPA, 2000: Supplemental Guidance to RAGS: Region 4 Bulletins: Human Health Risk Assessment

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/001

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Inhalation	Current Military Base Personnel	Adult	Fugative dust	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<u>Chronic Daily Intake (CDI) Equations</u> CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$
				RR	Respiration Rate	0.55	m3/hour	USEPA, 1997	
				ET	Exposure Time	8	hours/day	Prof Judge	
				EF	Exposure Frequency	250	days/year	USEPA, 2001	
				ED	Exposure Duration	4	years	Std Tour of Duty	
				PEF	Particulate Emission Factor	1.32E+09	m3/kg	Cowherd, et al., 1995	
	Future Trespassers	Adolescent	Fugative dust	BW	Body Weight	70	kg	USEPA, 1997	CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	1,460	days	USEPA, 1989	
				C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				RR	Respiration Rate	0.576	m3/hour	USEPA, 1997	
				ET	Exposure Time	4.04	hours/day	USEPA, 1997	
Inhalation	Future Residents	Adult	Fugative dust	EF	Exposure Frequency	52	days/year	Prof Judge	CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$
				ED	Exposure Duration	10	years	USEPA, 2000	
				PEF	Particulate Emission Factor	1.32E+09	m3/kg	Cowherd, et al., 1995	
				BW	Body Weight	45	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,650	days	USEPA, 1989	
	Young Child	Young Child	Fugative dust	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$
				RR	Respiration Rate	0.308	m3/hour	USEPA, 1997	
				ET	Exposure Time	5.57	hours/day	USEPA, 1997	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	6	years	USEPA, 1993	
				PEF	Particulate Emission Factor	1.32E+09	m3/kg	Cowherd, et al., 1995	
Inhalation	Young Child	Young Child	Fugative dust	BW	Body Weight	15	kg	USEPA, 1997	CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

TABLE 4.1a.RME
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Inhalation (Cont)	Future Construction Workers	Adult	Fugative dust	C RR ET EF ED PEF BW AT-C AT-N	Contaminant Concentration in Soil Respiration Rate Exposure Time Exposure Frequency Exposure Duration Particulate Emission Factor Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer)	Chemical Specific 3.3 8 250 1 2.77E+06 70 25,550 365	mg/kg m3/hour hours/day days/year years m3/kg kg days days	Chemical Specific USEPA, 1997 USEPA, 1991 USEPA, 2001 Prof Judge USEPA, 2001a USEPA, 1997 USEPA, 1989 USEPA, 1989	<u>Chronic Daily Intake (CDI) Equations</u> CDI (mg/kg-day) = $C \times IR \times ET \times EF \times ED \times 1/PEF \times 1/BW \times 1/AT$

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.1

Prof Judge - Professional Judgment

Std Tour of Duty - Standard Tour of Duty

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

Sources:

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/001

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/001

USEPA, 1991: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual Supplemental Guidance: Standard Default Exposure Factor

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 199

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

USEPA, 2000: Supplemental Guidance to RAGS: Region 4 Bulletins: Human Health Risk Assessment

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/001

USEPA, 2001a. Draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Ingestion	Future Residents	Adult	Groundwater	C IR-W EF ED BW AT-C AT-N	Contaminant Concentration in Groundwater Ingestion Rate of Groundwater Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer)	Chemical Specific 2 350 24 70 25,550 8,760	mg/L L/hour days/year years kg days days	Chemical Specific USEPA, 1993 USEPA, 2001 USEPA, 1993 USEPA, 1997 USEPA, 1989 USEPA, 1989	Chronic Daily Intake (CDI) Equations CDI (mg/kg-day) = $C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$
		Young Child	Groundwater	C IR-W EF ED BW AT-C AT-N	Contaminant Concentration in Groundwater Ingestion Rate of Groundwater Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer)	Chemical Specific 1 350 6 15 25,550 2,190	mg/L L/hour days/year years kg days days	Chemical Specific USEPA, 1989 USEPA, 1993 USEPA, 1993 USEPA, 1997 USEPA, 1989 USEPA, 1989	CDI (mg/kg-day) = $C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$
Dermal	Future Construction Workers	Adult	Groundwater	C CF SA PC tau t* B ET EF ED BW AT-C AT-N	Contaminant Concentration in Groundwater Conversion Factor Surface Area Available for Contact Permeability Constant Lag Time Time to Reach Steady State Permeability Coefficient of a Compound Exposure Time Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer)	Chemical Specific 1.00E-03 3,300 Chemical Specific Chemical Specific Chemical Specific Chemical Specific 2.6 250 1 70 25,550 365	mg/L L/cm3 cm2 cm/hour hour hour NA hours/day days/year years kg days days	Chemical Specific USEPA, 1989 USEPA, 2001 USEPA, 2001 USEPA, 2001 USEPA, 2001 USEPA, 2001 Prof Judge USEPA, 2001 Prof Judge USEPA, 1997 USEPA, 1989 USEPA, 1989	Dermally Adjusted Dose (DAD) Equations DAD (mg/kg-day) = Inorganics $(C \times CF \times K_p \times SA \times EF \times ED \times ET) / (BW \times AT)$ Organics: $ET \leq t^*$ $(C \times CF \times (2 \times K_p \times \text{SQRT}(6 \times \text{tau} \times ET / \pi))) \times SA \times EF \times ED / (BW \times AT)$ Organics: $ET > t^*$ $(C \times CF \times (K_p \times (ET / (1 + B) + 2 \times \text{tau} \times ((1 + 3 \times B) / (1 + B)))) \times SA \times EF \times ED / (BW \times AT)$

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Dermal (Cont)	Future Residents	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> DAD (mg/kg-day) = Inorganics $(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)$ Organics: $ET \leq t^*$ $(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)$ Organics: $ET > t^*$ $(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B))))*SA*EF*ED)/(BW*AT)$
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	18,000	cm2	USEPA, 2001	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2001	
				tau	Lag Time	Chemical Specific	hour	USEPA, 2001	
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2001	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2001	
				ET	Exposure Time	0.58	hours/day	USEPA, 2001	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	24	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
		Young Child	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	DAD (mg/kg-day) = Inorganics $(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)$ Organics: $ET \leq t^*$ $(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)$ Organics: $ET > t^*$ $(C*CF*(Kp*(ET/(1+B)+2*tau*((1+3*B)/(1+B))))*SA*EF*ED)/(BW*AT)$
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2001	
				PC	Permeability Constant	Chemical Specific	cm/hour	USEPA, 2001	
				tau	Lag Time	Chemical Specific	hour	USEPA, 2001	
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2001	
				B	Permeability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2001	
				ET	Exposure Time	1	hours/day	USEPA, 2001	
				EF	Exposure Frequency	350	days/year	USEPA, 1993	
				ED	Exposure Duration	6	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used

Chemical Specific - See Table 3.2

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/001

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/001

TABLE 4.2a.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Inhalation	Future Residents	Adult	Tap	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	<u>Chronic Daily Intake (CDI) Equations</u> $CDI (mg/kg-day) = C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$
				IR-W	Ingestion Rate of Groundwater	2	L/hour	USEPA, 1993	
				EF	Exposure Frequency	350	days/year	USEPA, 2001	
				ED	Exposure Duration	24	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

Notes

(1) In the absense of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.2

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.

TABLE 4.1.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Ingestion	Future Residents	Adult	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<u>Chronic Daily Intake (CDI) Equations</u> $CDI (mg/kg-day) = C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/AT$
				IR-S	Ingestion Rate of Soil	50	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	7	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
		Young Child	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	$CDI (mg/kg-day) = C \times IR \times CF \times FI \times EF \times ED \times 1/BW \times 1/AT$
				IR-S	Ingestion Rate of Soil	100	mg/day	USEPA, 1993	
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				FI	Fraction Ingested from Source	1	NA	Prof Judge	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	2	years	USEPA, 1993	
Dermal	Future Residents	Adult	Surface Soil	BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
				C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> $DAD (mg/kg-day) = C \times CF \times SA \times AF \times ABS \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	5,700	cm ² /day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.01	mg/cm ²	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	7	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	

TABLE 4.1.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Dermal (Cont)	Future Residents	Young Child	Surface Soil	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> DAD (mg/kg-day) = $C \times CF \times SA \times AF \times ABS \times EF \times ED \times 1/BW \times 1/AT$
				CF	Conversion Factor	1.00E-06	kg/mg	USEPA, 1989	
				SA	Surface Area Available for Contact	2,800	cm2/day	USEPA, 2001	
				AF	Soil to Skin Adherence Factor	0.04	mg/cm2	USEPA, 2001	
				ABS	Absorption Factor	(1)	NA	USEPA, 2001	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	2	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

CDI - Chronic Daily Intake

Chemical Specific - See Table 3.1

DAD - Dermally Adjusted Dose

Prof Judge - Professional Judgment

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 1993.

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/005.

TABLE 4.1a.CT
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091;
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current, Future
Medium: Surface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Inhalation	Future Residents	Adult	Fugative dust	C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	$CDI (mg/kg-day) = \frac{C \times IR \times ET \times EF \times ED \times 1/PEF}{1/BW \times 1/AT}$
				RR	Respiration Rate	0.55	m3/hour	USEPA, 1997	
				ET	Exposure Time	1.5	hours/day	USEPA, 1997	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	7	years	USEPA, 1993	
				PEF	Particulate Emission Factor	1.32E+09	m3/kg	Cowherd, et al., 1995	
				BW	Body Weight	70	kg	USEPA, 1997	
		Young Child	Fugative dust	AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	$CDI (mg/kg-day) = \frac{C \times IR \times ET \times EF \times ED \times 1/PEF}{1/BW \times 1/AT}$
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
				C	Contaminant Concentration in Soil	Chemical Specific	mg/kg	Chemical Specific	
				RR	Respiration Rate	0.308	m3/hour	USEPA, 1997	
				ET	Exposure Time	5.57	hours/day	USEPA, 1997	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	2	years	USEPA, 1993	
				PEF	Particulate Emission Factor	1.32E+09	m3/kg	Cowherd, et al., 1995	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.1

Sources:

Cowherd, et al., 1995: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination. OHEA. EPA/600/8-85/00.

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/00.

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 199

USEPA, 2004: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/00

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

TABLE 4.2.CT
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Ingestion	Future Residents	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	<u>Chronic Daily Intake (CDI) Equations</u> $CDI (mg/kg-day) = C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$
				IR-W	Ingestion Rate of Groundwater	1.4	L/hour	USEPA, 1993	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	7	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
		Young Child	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	$CDI (mg/kg-day) = C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$
				IR-W	Ingestion Rate of Groundwater	1	L/hour	USEPA, 1989	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	2	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
Dermal	Future Residents	Adult	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> $DAD (mg/kg-day) =$ <u>Inorganics</u> $(C \times CF \times Kp \times SA \times EF \times ED \times ET) / (BW \times AT)$ <u>Organics: ET <= t*</u> $(C \times CF \times (2 \times Kp \times SQRT(6 \times tau \times ET / pi))) \times SA \times EF \times ED / (BW \times A1)$ <u>Organics: ET > t*</u> $(C \times CF \times (Kp \times (ET / (1 + B) + 2 \times tau \times ((1 + 3 \times B) / (1 + B)))) \times SA \times EF \times ED / (BW \times A1)$
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	18,000	cm2	USEPA, 2001	
				PC	PeCTability Constant	Chemical Specific	cm/hour	USEPA, 2001	
				tau	Lag Time	Chemical Specific	hour	USEPA, 2001	
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2001	
				B	PeCTability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2001	
				ET	Exposure Time	0.25	hours/day	USEPA, 2001	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	7	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	

TABLE 4.2.CT
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Dermal	Future Residents	Young Child	Groundwater	C	Contaminant Concentration in Groundwater	Chemical Specific	mg/L	Chemical Specific	<u>Dermally Adjusted Dose (DAD) Equations</u> $DAD (mg/kg-day) =$ <u>Inorganics</u> $(C*CF*Kp*SA*EF*ED*ET)/(BW*AT)$ <u>Organics: ET ≤ t*</u> $(C*CF*(2*Kp*SQRT(6*tau*ET/pi))*SA*EF*ED)/(BW*AT)$ <u>Organics: ET > t*</u> $(C*CF*(Kp*(ET/(1-B)+2*tau*((1+3*B)/(1+B))))*SA*EF*ED)/(BW*AT)$
				CF	Conversion Factor	1.00E-03	L/cm3	USEPA, 1989	
				SA	Surface Area Available for Contact	6,600	cm2	USEPA, 2001	
				PC	PeCTability Constant	Chemical Specific	cm/hour	USEPA, 2001	
				tau	Lag Time	Chemical Specific	hour	USEPA, 2001	
				t*	Time to Reach Steady State	Chemical Specific	hour	USEPA, 2001	
				B	PeCTability Coefficient of a Compound	Chemical Specific	NA	USEPA, 2001	
				ET	Exposure Time	0.33	hours/day	USEPA, 2001	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED	Exposure Duration	2	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.2

CDI - Chronic Daily Intake

DAD - Dermally Adjusted Dose

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol I, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/00.

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 199

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

USEPA, 2004: Risk Assessment Guidance for Superfund Vol I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R-99/00

TABLE 4.2a.CT
VALUES USED FOR DAILY INTAKE CALCULATION:
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/Reference	Intake Equation/Model Name
Inhalation	Future Residents	Adult	Tap	C IR-W EF ED BW AT-C AT-N	Contaminant Concentration in Groundwater; Ingestion Rate of Groundwater; Exposure Frequency Exposure Duration Body Weight Averaging Time (Cancer) Averaging Time (Non-Cancer)	Chemical Specific 1.4 234 7 70 25,550 2,555	mg/L L/hour days/year years kg days days	Chemical Specific USEPA, 1993 USEPA, 1993 USEPA, 1993 USEPA, 1997 USEPA, 1989 USEPA, 1989	Chronic Daily Intake (CDI) Equations CDI (mg/kg-day) = $C \times IR-W \times EF \times ED \times 1/BW \times 1/AT$

Notes

(1) In the absence of USEPA RAGS Part E ABS values, USEPA Region IV default values of 0.01 organics and 0.001 for inorganics were used.

Chemical Specific - See Table 3.2

CDI - Chronic Daily Intake

DAD - Dermal Adjusted Dose

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund Vol 1, Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/001

USEPA, 1993: "Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure." November, 199.

USEPA, 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
1,2,3-Trichlorobenzene (1)	Chronic	1.00E-02	mg/kg/day	100%	1.00E-02	mg/kg/day	Kidney	1000/1	IRIS	6/8/2005
Naphthalene	Chronic	2.00E-02	mg/kg/day	100%	2.00E-02	mg/kg/day	Whole Body	3000/1	IRIS	6/8/2005
Tetrachloroethene (PCE)	Chronic	1.00E-02	mg/kg/day	100%	1.00E-02	mg/kg/day	Liver / Whole Body	1000/1	IRIS	6/8/2005
Cadmium	Chronic	5.00E-04	mg/kg/day	5%	2.50E-05	mg/kg/day	Kidney	10/1	IRIS	2/2/2005

Notes:

- (1) Refer to the risk calculation spreadsheets presented in Appendix H
(2) Adjusted dermal RfD = Oral RfD * Adj Factor

Sources:

IRIS = Integrated Risk Information System

NA = Not Applicable

(1) - Values for 1,2,4-Trichlorobenzene

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s)
1,2,3-Trichlorobenzene ⁽¹⁾	Chronic	3.5E-03	mg/m3	1.00E-03	mg/kg/day	Liver	100/1	NA	7/1/1997
Naphthalene	Chronic	3.2E-03	mg/m3	8.57E-04	mg/kg/day	RsS	3000/1	IRIS	6/8/2005
Tetrachloroethene (PCE)	Chronic	4.9E-01	mg/m3	1.00E-02	mg/kg/day	Liver / Kidney / Brain	300/1	Other	6/20/1997
Cadmium	Chronic	NA	NA	NA	NA	NA	1/1	NA	3/4/1999

Notes:

NA = Not Applicable

Target Organ Abbreviations:

RsS = Respiratory System

Sources:

IRIS = Integrated Risk Information System

(1) - Values for 1,2,4-Trichlorobenzene

TABLE 6.1
CANCER TOXICITY DATA – ORAL/DERMAL
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (¹)	Absorbed Cancer Slope Factor for Dermal (²)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s)
1,2,3-Trichlorobenzene (¹)	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene (PCE)	5.40E-01	1 / (mg/kg/day)	100%	5.40E-01	1 / (mg/kg/day)	C	Other	7/1/1985
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

- (1) Refer to the risk calculation spreadsheets presented in Appendix H
(2) Adjusted dermal CSF = Oral CSF / Adj Factor

NA = Not Applicable

- (1) - Values for 1,2,4-Trichlorobenzene

EPA Group:

- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Weight of Evidence:

- Known/Likely (EPA classes A, B1, B2, C)
- Cannot be Determined (EPA class D)
- Not Likely (EPA class E)

TABLE 6.2
CANCER TOXICITY DATA -- INHALATION
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s)
1,2,3-Trichlorobenzene ⁽¹⁾	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene (PCE)	5.7E-06	ug/m3	2.10E-02	mg/kg/day	C	Other	4/1/1987
Cadmium	1.8E-03	ug/m3	6.30E+00	mg/kg/day	B1	IRIS	2/2/2005

Notes:

EPA Group:

- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

(1) - Values for 1,2,4-Trichlorobenzene

Sources:

IRIS = Integrated Risk Information System

NA = Not Applicable

Weight of Evidence:

- Known/Likely (EPA classes A, B1, B2, C)
- Cannot be Determined (EPA class D)
- Not Likely (EPA class E)

TABLE 7.1.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Military Base Personnel
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Cadmium	5.15E+00	mg/kg	2.9E-07	mg/kg-day	NA	--	--	5.0E-06	mg/kg-day	5.0E-04	mg/kg-day	1.0E-02
			Ingestion Total										--			1.0E-02
			Dermal	Cadmium	5.15E+00	mg/kg	1.9E-09	mg/kg-day	NA	--	--	3.3E-08	mg/kg-day	2.5E-05	mg/kg-day	1.3E-03
			Dermal Total										--			1.3E-03
			Exposure Point Total										--			1.1E-02
	Exposure Medium Total										--			1.1E-02		
	Air	Fugative Dust	Inhalation	Cadmium	5.15E+00	mg/kg	9.6E-12	mg/kg-day	6.3E+00	1/(mg/kg-day)	6.1E-11	1.7E-10	mg/kg-day	NA	--	--
			Inhalation Total										6.1E-11			--
			Exposure Point Total										6.1E-11			--
		Exposure Medium Total										6.1E-11			--	
		Surface Soil Total										6.1E-11			1.1E-02	
	Total of Receptor Risks Across All Media										6.1E-11	Total of Receptor Hazards Across All Media				1.1E-02

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient	
							Value	Units	Value	Units		Value	Units	Value	Units		
Surface Soil	Surface Soil	Surface Soil	Ingestion	Cadmium	4.16E+00	mg/kg	1.9E-07	mg/kg-day	NA	--	--	1.3E-06	mg/kg-day	5.0E-04	mg/kg-day	2.6E-03	
			Ingestion Total									--					2.6E-03
			Dermal	Cadmium	4.16E+00	mg/kg	2.0E-09	mg/kg-day	NA	--	--	1.4E-08	mg/kg-day	2.5E-05	mg/kg-day	5.6E-04	
			Dermal Total									--					5.6E-04
			Exposure Point Total									--					3.2E-03
			Exposure Medium Total									--					3.2E-03
	Air	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	3.3E-12	mg/kg-day	6.3E+00	1/(mg/kg-day)	2.1E-11	2.3E-11	mg/kg-day	NA	--	--	
			Inhalation Total									2.1E-11					--
			Exposure Point Total									2.1E-11					--
			Exposure Medium Total									2.1E-11					--
	Surface Soil Total											2.1E-11					3.2E-03
Total of Receptor Risks Across All Media											2.1E-11	Total of Receptor Hazards Across All Media				3.2E-03	

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations					
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient	
							Value	Units	Value	Units		Value	Units	Value	Units		
Surface Soil	Surface Soil	Surface Soil	Ingestion	Cadmium	4.16E+00	mg/kg	2.0E-06	mg/kg-day	NA	--	--	5.7E-06	mg/kg-day	5.0E-04	mg/kg-day	1.1E-02	
			Ingestion Total														--
			Dermal	Cadmium	4.16E+00	mg/kg	7.8E-09	mg/kg-day	NA	--	--	2.3E-08	mg/kg-day	2.5E-05	mg/kg-day	9.1E-04	
			Dermal Total														--
			Exposure Point Total										--	--	1.2E-02		
			Exposure Medium Total										--	--	1.2E-02		
	Air	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	1.2E-11	mg/kg-day	6.3E+00	1/(mg/kg-day)	7.7E-11	3.6E-11	mg/kg-day	NA	--	--	
			Inhalation Total														7.7E-11
			Exposure Point Total										7.7E-11	--	--		
			Exposure Medium Total										7.7E-11	--	--		
	Surface Soil Total											7.7E-11	--	1.2E-02			
	Groundwater	Groundwater	Groundwater	Ingestion	1,2,3-Trichlorobenzene	7.30E-04	mg/L	6.9E-06	mg/kg-day	NA	--	--	2.0E-05	mg/kg-day	1.0E-02	mg/kg-day	2.0E-03
Naphthalene				5.00E-03	mg/L	4.7E-05	mg/kg-day	NA	--	--	1.4E-04	mg/kg-day	2.0E-02	mg/kg-day	6.8E-03		
Tetrachloroethene (PCE)				2.70E-02	mg/L	2.5E-04	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.4E-04	7.4E-04	mg/kg-day	1.0E-02	mg/kg-day	7.4E-02		
Ingestion Total				1.4E-04										8.3E-02			
Dermal				1,2,3-Trichlorobenzene	7.30E-04	mg/L	9.8E-06	mg/kg-day	NA	--	--	2.9E-05	mg/kg-day	1.0E-02	mg/kg-day	2.9E-03	
Naphthalene				5.00E-03	mg/L	3.1E-05	mg/kg-day	NA	--	--	9.1E-05	mg/kg-day	2.0E-02	mg/kg-day	4.6E-03		
Tetrachloroethene (PCE)				2.70E-02	mg/L	1.5E-04	mg/kg-day	5.4E-01	1/(mg/kg-day)	8.2E-05	4.4E-04	mg/kg-day	1.0E-02	mg/kg-day	4.4E-02		
Dermal Total				8.2E-05										5.2E-02			
Exposure Point Total										2.2E-04	1.3E-01						
Exposure Medium Total										2.2E-04	1.3E-01						
Air		Water Vapors from Showerhead	Inhalation	1,2,3-Trichlorobenzene	7.30E-04	mg/L	6.9E-06	mg/kg-day	NA	--	--	2.0E-05	mg/kg-day	1.0E-03	mg/kg-day	2.0E-02	
			Naphthalene	5.00E-03	mg/L	4.7E-05	mg/kg-day	NA	--	--	1.4E-04	mg/kg-day	8.6E-04	mg/kg-day	1.6E-01		
			Tetrachloroethene (PCE)	2.70E-02	mg/L	2.5E-04	mg/kg-day	2.1E-02	1/(mg/kg-day)	5.3E-06	7.4E-04	mg/kg-day	1.0E-02	mg/kg-day	7.4E-02		
			Inhalation Total	5.3E-06										2.5E-01			
Exposure Point Total										5.3E-06	2.5E-01						
Exposure Medium Total										5.3E-06	2.5E-01						
Groundwater Total											2.2E-04	3.9E-01					
Total of Receptor Risks Across All Media											2.2E-04	Total of Receptor Hazards Across All Media				4.0E-01	

TABLE 7.3.CT
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
CENTRAL TENDENCY
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Cadmium	4.16E+00	mg/kg	1.9E-07	mg/kg-day	NA	--	--	1.9E-06	mg/kg-day	5.0E-04	mg/kg-day	3.8E-03
			Ingestion Total									--	3.8E-03			
			Dermal	Cadmium	4.16E+00	mg/kg	2.2E-10	mg/kg-day	NA	--	--	2.2E-09	mg/kg-day	2.5E-05	mg/kg-day	8.7E-05
			Dermal Total									--	8.7E-05			
			Exposure Point Total									--	3.9E-03			
			Exposure Medium Total									--	3.9E-03			
	Air	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	2.4E-12	mg/kg-day	6.3E+00	1/(mg/kg-day)	1.5E-11	2.4E-11	mg/kg-day	NA	--	--
			Inhalation Total									1.5E-11	--			
			Exposure Point Total									1.5E-11	--			
			Exposure Medium Total									1.5E-11	--			
			Surface Soil Total									1.5E-11	3.9E-03			
Groundwater	Groundwater	Groundwater	Ingestion	1,2,3-Trichlorobenzene	7.30E-04	mg/L	9.4E-07	mg/kg-day	NA	--	--	9.4E-06	mg/kg-day	1.0E-02	mg/kg-day	9.4E-04
			Naphthalene	5.00E-03	mg/L	6.4E-06	mg/kg-day	NA	--	--	6.4E-05	mg/kg-day	2.0E-02	mg/kg-day	3.2E-03	
			Tetrachloroethene (PCE)	2.70E-02	mg/L	3.5E-05	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.9E-05	3.5E-04	mg/kg-day	1.0E-02	mg/kg-day	3.5E-02	
			Ingestion Total									1.9E-05	3.9E-02			
			Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.3E-06	mg/kg-day	NA	--	--	1.3E-05	mg/kg-day	1.0E-02	mg/kg-day	1.3E-03
			Naphthalene	5.00E-03	mg/L	4.0E-06	mg/kg-day	NA	--	--	4.0E-05	mg/kg-day	2.0E-02	mg/kg-day	2.0E-03	
			Tetrachloroethene (PCE)	2.70E-02	mg/L	1.9E-05	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-05	1.9E-04	mg/kg-day	1.0E-02	mg/kg-day	1.9E-02	
			Dermal Total									1.0E-05	2.3E-02			
			Exposure Point Total									2.9E-05	6.1E-02			
	Exposure Medium Total									2.9E-05	6.1E-02					
	Air	Water Vapors from Showerhead	Inhalation	1,2,3-Trichlorobenzene	7.30E-04	mg/L	9.4E-07	mg/kg-day	NA	--	--	9.4E-06	mg/kg-day	1.0E-03	mg/kg-day	9.4E-03
			Naphthalene	5.00E-03	mg/L	6.4E-06	mg/kg-day	NA	--	--	6.4E-05	mg/kg-day	8.6E-04	mg/kg-day	7.5E-02	
			Tetrachloroethene (PCE)	2.70E-02	mg/L	3.5E-05	mg/kg-day	2.1E-02	1/(mg/kg-day)	7.3E-07	3.5E-04	mg/kg-day	1.0E-02	mg/kg-day	3.5E-02	
			Inhalation Total									7.3E-07	1.2E-01			
			Exposure Point Total									7.3E-07	1.2E-01			
	Exposure Medium Total									7.3E-07	1.2E-01					
Groundwater Total											3.0E-05	1.8E-01				
Total of Receptor Risks Across All Media											3.0E-05	Total of Receptor Hazards Across All Media				1.8E-01

TABLE 7.4.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD / RfC		Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Surface Soil	Surface Soil	Ingestion	Cadmium	4.16E+00	mg/kg	4.6E-06	mg/kg-day	NA	--	--	5.3E-05	mg/kg-day	5.0E-04	mg/kg-day	1.1E-01
			Ingestion Total										--			1.1E-01
			Dermal	Cadmium	4.16E+00	mg/kg	1.3E-08	mg/kg-day	NA	--	--	1.5E-07	mg/kg-day	2.5E-05	mg/kg-day	6.0E-03
			Dermal Total										--			6.0E-03
			Exposure Point Total										--			1.1E-01
			Exposure Medium Total										--			1.1E-01
	Air	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	3.0E-11	mg/kg-day	6.3E+00	1/(mg/kg-day)	1.9E-10	3.5E-10	mg/kg-day	NA	--	--
			Inhalation Total										1.9E-10			--
			Exposure Point Total										1.9E-10			--
			Exposure Medium Total										1.9E-10			--
	Surface Soil Total										1.9E-10			1.1E-01		
	Groundwater	Groundwater	Tap	Ingestion	1,2,3-Trichlorobenzene	7.30E-04	mg/L	4.0E-06	mg/kg-day	NA	--	--	4.7E-05	mg/kg-day	1.0E-02	mg/kg-day
Naphthalene				5.00E-03	mg/L	2.7E-05	mg/kg-day	NA	--	--	3.2E-04	mg/kg-day	2.0E-02	mg/kg-day	1.6E-02	
Tetrachloroethene (PCE)				2.70E-02	mg/L	1.5E-04	mg/kg-day	5.4E-01	1/(mg/kg-day)	8.0E-05	1.7E-03	mg/kg-day	1.0E-02	mg/kg-day	1.7E-01	
Ingestion Total										8.0E-05			1.9E-01			
Dermal				1,2,3-Trichlorobenzene	7.30E-04	mg/L	5.5E-06	mg/kg-day	NA	--	--	6.5E-05	mg/kg-day	1.0E-02	mg/kg-day	6.5E-03
Naphthalene				5.00E-03	mg/L	1.8E-05	mg/kg-day	NA	--	--	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	
Tetrachloroethene (PCE)				2.70E-02	mg/L	8.5E-05	mg/kg-day	5.4E-01	1/(mg/kg-day)	4.6E-05	9.9E-04	mg/kg-day	1.0E-02	mg/kg-day	9.9E-02	
Dermal Total										4.6E-05			1.2E-01			
Exposure Point Total										1.3E-04			3.1E-01			
Exposure Medium Total										1.3E-04			3.1E-01			
Groundwater Total										1.3E-04			3.1E-01			
Total of Receptor Risks Across All Media										4.2E-04	Total of Receptor Hazards Across All Media				4.2E-01	

Scenario 1: Indeterminate	Receptor Population: Residents	Receptor Age: Young Child
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[illegible]

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
SWMU 136
RCRA FACILITY INVESTIGATION (CFO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Non-Cancer Hazard Calculations											
Value	Units	Value	Units	Concentration	Intake/Exposure	CSF / Unit Risk	Cancer Risk	Value	Units	Intake/Exposure	RfD / RfC	Quotient	Value	Units								
Surface Soil	Surface Soil	Ingestion	Ingestion	Cadmium	4.16E+00	mg/kg	2.8E-07	mg/kg-day	NA	--	2.0E-05	mg/kg-day	5.0E-04	mg/kg-day	3.9E-02							
					Ingestion Total																	
					Dermal	Dermal	Cadmium	4.16E+00	mg/kg	3.8E-10	mg/kg-day	NA	--	2.7E-08	mg/kg-day	2.5E-05	mg/kg-day	1.1E-03				
								Dermal Total														
	Surface Soil	Exposure Point Total	Exposure Medium Total	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	5.5E-09	mg/kg-day	6.3E+00	1/(mg/kg-day)	3.5E-08	mg/kg-day	3.9E-07	NA	--	4.0E-02				
							Inhalation Total															
							Exposure Point Total															
							Exposure Medium Total															
							Air	Fugative Dust	Inhalation	Cadmium	4.16E+00	mg/kg	5.5E-09	mg/kg-day	6.3E+00	1/(mg/kg-day)	3.5E-08	mg/kg-day	3.9E-07	NA	--	4.0E-02
											Exposure Point Total											
Surface Soil Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02					
					Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02				
						Dermal Total																
						Tetrahydroethene (PCE)	2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04		mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
					Naphthalene		5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
						Dermal Total																
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
Dermal Total																						
Groundwater Total		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
	Tetrahydroethene (PCE)						2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
	Dermal Total																					
	Groundwater Total	Groundwater	Tap	Dermal	1,2,3-Trichlorobenzene	7.30E-04	mg/L	1.1E-07	mg/kg-day	NA	--	8.0E-06	mg/kg-day	1.0E-02	mg/kg-day	8.0E-04	1.4E-03	1.3E-02				
						Naphthalene	5.00E-03	mg/L	4.0E-07	mg/kg-day	NA	--	2.8E-05	mg/kg-day	2.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
							Dermal Total															
Tetrahydroethene (PCE)							2.70E-02	mg/L	1.9E-06	mg/kg-day	5.4E-01	1/(mg/kg-day)	1.0E-06	mg/kg-day	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	1.5E-02			
		Groundwater																				

TABLE 8.1.RME
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				Cancer Risk	Non-Cancer Hazard Calculations				Quotient
					Value	Units	Intake/Exposure Concentration		CSF / Unit Risk			Intake/Exposure Concentration		RfD / RfC		
							Value	Units	Value	Units		Value	Units	Value	Units	
			Total													
NOT APPLICABLE																
			Total													
			Exposure Point Total													
			Exposure Medium Total													
			Total													
			Exposure Point Total													
			Exposure Medium Total													
Total																
Total of Receptor Risks Across All Media										Total of Receptor Hazards Across All Media						

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Current
Receptor Population: Military Base Personnel
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total	
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.01	--	0.00	0.01	
			Chemical Total	--	--	--	--	--	0.01	--	0.00	0.01		
		Exposure Point Total							--					0.01
		Exposure Medium Total							--					0.01
	Air	Fugative Dust	Cadmium	--	6.1E-11	--	--	6.05E-11	Kidney	--	--	--	--	
			Chemical Total	--	6.1E-11	--	--	6.05E-11	--	--	--	--		
		Exposure Point Total							6.05E-11					--
		Exposure Medium Total							6.05E-11					--
	Surface Soil Total							6.05E-11					0.01	
	Military Base Personnel Total							6.05E-11					0.01	

Total Risk Across Surface Soil 6.1E-11
Total Risk Across All Media and All Exposure Routes 6.1E-11

Total Hazard Index Across Surface Soil 0.01
Total Hazard Index Across All Media and All Exposure Routes 0.01

All Exposure Routes:
Total Kidney HI = 0.01

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Trespassers
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.00	--	0.00	0.00
			Chemical Total	--	--	--	--	--	0.00	--	0.00	0.00	
		Exposure Point Total							--	0.00			
		Exposure Medium Total							--	0.00			
	Air	Fugative Dust	Cadmium	--	2.1E-11	--	--	2.09E-11	Kidney	--	--	--	--
			Chemical Total	--	2.1E-11	--	--	2.09E-11	--	--	--	--	
		Exposure Point Total							2.09E-11	--			
		Exposure Medium Total							2.09E-11	--			
	Surface Soil Total							2.09E-11	0.00				
	Adolescent Trespassers Total							2.09E-11	0.00				

Total Risk Across Surface Soil	2.1E-11	Total Hazard Index Across Surface Soil	0.00319
Total Risk Across All Media and All Exposure Routes	2.1E-11	Hazard Index Across All Media and All Exposure Routes	0.00319

All Exposure Routes:
Total Kidney HI = 0.00

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient						
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total		
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.01	--	0.00	0.01		
			Chemical Total	--	--	--	--	--		0.01	--	0.00	0.01		
			Exposure Point Total										0.01		
			Exposure Medium Total										0.01		
	Air	Fugative Dust	Cadmium	--	7.7E-11	--	--	7.69E-11	Kidney	--	--	--	--		
			Chemical Total	--	7.7E-11	--	--	7.69E-11		--	--	--	--		
			Exposure Point Total										--		
			Exposure Medium Total										--		
			Surface Soil Total												0.01
Groundwater	Groundwater	Tap	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver	0.00	--	0.00	0.00		
			Naphthalene	--	--	--	--	--	(o) Whole Body, (i) RsS	0.01	--	0.00	0.01		
			Tetrachloroethene (PCE)	1.4E-04	--	8.2E-05	--	2.19E-04	(o) Liver / Whole Body, (i)	0.07	--	0.04	0.12		
			Chemical Total	1.4E-04	--	8.2E-05	--	2.19E-04		0.08	--	0.05	0.13		
			Exposure Point Total										0.13		
	Air	Water Vapors from Showerhead	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver	--	0.02	--	0.02		
			Naphthalene	--	--	--	--	--	(o) Whole Body, (i) RsS	--	0.15	--	0.15		
			Tetrachloroethene (PCE)	--	5.1E-06	--	--	5.07E-06	(o) Liver / Whole Body, (i)	--	0.01	--	0.01		
			Chemical Total	--	5.1E-06	--	--	5.07E-06		--	0.18	--	0.18		
			Exposure Point Total										0.18		
			Exposure Medium Total										0.18		
			Groundwater Total												0.31
			Adult Residents Total												0.32

Notes:
Target Organ Abbreviations:
RsS = Respiratory System

(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil = 7.7E-11
Total Risk Across Groundwater = 2.2E-04
Total Risk Across All Media and All Exposure Routes = 2.2E-04

All Exposure Routes:
Total Kidney HI = 0.01

Inhalation Exposure Routes:
Inhalation Kidney HI = 5.28E-03
Inhalation Liver HI = 2.53E-02
Inhalation Respiratory System HI = 1.52E-01

total Hazard Index Across Surface Soil = 0.01
al Hazard Index Across Groundwater = 0.31
as All Media and All Exposure Routes = 0.32

Oral and Dermal Exposure Routes:
Oral / Dermal Whole Body HI = 0.13
Oral / Dermal Kidney HI = 0.00
Oral / Dermal Liver HI = 0.12

TABLE 9.3.CT
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
CENTRAL TENDENCY
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total	
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.00	--	0.00	0.00	
			Chemical Total	--	--	--	--	0.00		--	0.00	0.00		
			Exposure Point Total	--						0.00				
			Exposure Medium Total	--						0.00				
	Air	Fugative Dust	Cadmium	--	1.5E-11	--	--	1.50E-11	Kidney	--	--	--	--	
			Chemical Total	--	1.5E-11	--	--	1.50E-11		--	--	--	--	
			Exposure Point Total	1.50E-11						--				
			Exposure Medium Total	1.50E-11						--				
	Surface Soil Total							1.50E-11	0.00					
	Groundwater	Groundwater	Tap	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver (o) Whole Body, (i) RaS (o) Liver / Whole Body, (i)	0.00	--	0.00	0.00
				Naphthalene	--	--	--	--	--		0.00	--	0.00	0.01
				Tetrachloroethene (PCE)	1.9E-05	--	1.0E-05	--	2.92E-05		0.03	--	0.02	0.05
				Chemical Total	1.9E-05	--	1.0E-05	--	2.92E-05		0.04	--	0.02	0.06
		Exposure Point Total							2.92E-05	0.06				
		Exposure Medium Total							2.92E-05	0.06				
Air		Water Vapors from Showerhead	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver (o) Whole Body, (i) RaS (o) Liver / Whole Body, (i)	--	0.01	--	0.01	
			Naphthalene	--	--	--	--	--		--	0.07	--	0.07	
			Tetrachloroethene (PCE)	--	6.9E-07	--	--	6.92E-07		--	0.00	--	0.00	
			Chemical Total	--	6.9E-07	--	--	6.92E-07		--	0.08	--	0.08	
Exposure Point Total							6.92E-07	0.08						
Exposure Medium Total							6.92E-07	0.08						
Groundwater Total							2.98E-05	0.14						
Adult Residents Total							2.98E-05	0.15						

Notes:

Target Organ Abbreviations:
RsS = Respiratory System

(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil

1.5E-11

Total Risk Across Groundwater

3.0E-05

Total Risk Across All Media and All Exposure Routes

3.0E-05

All Exposure Routes:

Total Kidney HI =

0.00

Inhalation Exposure Routes:

Inhalation Kidney HI =

2.47E-03

Inhalation Liver HI =

1.18E-02

Inhalation Respiratory System HI =

7.12E-02

Max Hazard Index Across Surface Soil

0.00

Max Hazard Index Across Groundwater

0.14

Max Hazard Index Across All Media and All Exposure Routes

0.15

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI =

0.06

Oral / Dermal Kidney HI =

0.00

Oral / Dermal Liver HI =

0.05

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient					
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total	
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.11	--	0.01	0.11	
			Chemical Total	--	--	--	--	--		0.11	--	0.01	0.11	
			Exposure Point Total										0.11	
			Exposure Medium Total										0.11	
	Air	Fugative Dust	Cadmium	--	1.9E-10	--	--	1.87E-10	Kidney	--	--	--	--	
			Chemical Total	--	1.9E-10	--	--	1.87E-10		--	--	--	--	
			Exposure Point Total										--	
			Exposure Medium Total										--	
								1.87E-10						--
								1.87E-10						--
Surface Soil Total							1.87E-10						0.11	
Groundwater	Groundwater	Tap	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver	0.00	--	0.01	0.01	
			Naphthalene	--	--	--	--	--	(o) Whole Body, (i) RsS	0.02	--	0.01	0.03	
			Tetrachloroethene (PCE)	8.0E-05	--	4.6E-05	--	1.26E-04	(o) Liver / Whole Body, (i)	0.17	--	0.10	0.27	
			Chemical Total	8.0E-05	--	4.6E-05	--	1.26E-04		0.19	--	0.12	0.31	
			Exposure Point Total										0.31	
			Exposure Medium Total										0.31	
	Groundwater Total							1.26E-04						0.31
Young Child Residents Total							1.26E-04						0.42	

Notes:

Target Organ Abbreviations:

RsS = Respiratory System

(o) Oral exposure

(i) Inhalation exposure

Total Risk Across Surface Soil

1.9E-10

Total Risk Across Groundwater

1.3E-04

Total Risk Across All Media and All Exposure Routes

1.3E-04

All Exposure Routes:

Total Kidney HI = 0.11

Inhalation Exposure Routes:

Inhalation Kidney HI = 0.00E+00

Inhalation Liver HI = 0.00E+00

Inhalation Respiratory System HI = 0.00E+00

Total Hazard Index Across Surface Soil

0.11

Total Hazard Index Across Groundwater

0.31

Total Hazard Index Across All Media and All Exposure Routes

0.42

Oral and Dermal Exposure Routes:

Oral / Dermal Whole Body HI = 0.30

Oral / Dermal Kidney HI = 0.01

Oral / Dermal Liver HI = 0.27

TABLE 9.4.CT
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPC
CENTRAL TENDENCY
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotients					
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total	
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.04	--	0.00	0.04	
			Chemical Total	--	--	--	--	--	0.04	--	0.00	0.04		
			Exposure Point Total											0.04
			Exposure Medium Total											0.04
	Air	Fugative Dust	Cadmium	--	4.2E-11	--	--	4.16E-11	Kidney	--	--	--	--	
			Chemical Total	--	4.2E-11	--	--	4.16E-11	--	--	--	--		
			Exposure Point Total						4.16E-11					--
			Exposure Medium Total						4.16E-11					--
	Surface Soil Total							4.16E-11					0.04	
	Groundwater	Groundwater	Tap	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver	0.00	--	0.00	0.01
Naphthalene				--	--	--	--	--	(o) Whole Body, (i) RsS	0.01	--	0.00	0.01	
Tetrachloroethene (PCE)				1.8E-05	--	5.9E-06	--	2.37E-05	(o) Liver / Whole Body, (i)	0.12	--	0.04	0.15	
Chemical Total				1.8E-05	--	5.9E-06	--	2.37E-05	0.13	--	0.04	0.17		
Exposure Point Total									2.37E-05					0.17
Exposure Medium Total									2.37E-05					0.17
Groundwater Total							2.37E-05					0.17		
Young Child Residents Total							2.37E-05					0.21		

Notes:
Target Organ Abbreviations:
RsS = Respiratory System

(o) Oral exposure
(i) Inhalation exposure

Total Risk Across Surface Soil
Total Risk Across Groundwater
Total Risk Across All Media and All Exposure Routes

All Exposure Routes:
Total Kidney HI =

Inhalation Exposure Routes:
Inhalation Kidney HI =
Inhalation Liver HI =
Inhalation Respiratory System HI =

nal Hazard Index Across Surface Soil
al Hazard Index Across Groundwater
ss All Media and All Exposure Routes

Oral and Dermal Exposure Routes:
Oral / Dermal Whole Body HI =
Oral / Dermal Kidney HI =
Oral / Dermal Liver HI =

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Construction Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Surface Soil	Cadmium	--	--	--	--	--	Kidney	0.04	--	0.00	0.04
			Chemical Total	--	--	--	--	--	0.04	--	0.00	0.04	
			Exposure Point Total						--	0.04			
		Exposure Medium Total						--	0.04				
	Air	Fugative Dust	Cadmium	--	3.5E-08	--	--	3.49E-08	Kidney	--	--	--	--
			Chemical Total	--	3.5E-08	--	--	3.49E-08	--	--	--	--	
			Exposure Point Total						3.49E-08	--			
		Exposure Medium Total						3.49E-08	--				
	Surface Soil Total								3.49E-08	0.04			
	Groundwater	Groundwater	Tap	1,2,3-Trichlorobenzene	--	--	--	--	--	(o) Kidney, (i) Liver	--	--	0.00
Naphthalene				--	--	--	--	--	(o) Whole Body, (i) RsS	--	--	0.00	0.00
Tetrachloroethene (PCE)				--	--	1.0E-06	--	1.02E-06	(o) Liver / Whole Body, (i) Liver / Kidney / Brain	--	--	0.01	0.01
Chemical Total				--	--	1.0E-06	--	1.02E-06	--	--	0.02	0.02	
Exposure Point Total									1.02E-06	0.02			
Exposure Medium Total								1.02E-06	0.02				
Groundwater Total								1.02E-06	0.02				
Construction Workers Total								1.05E-06	0.06				

Notes:
Target Organ Abbreviations:
RsS = Respiratory System

Total Risk Across Surface Soil	3.5E-08
Total Risk Across Groundwater	1.0E-06
Total Risk Across All Media and All Exposure Routes	1.1E-06
All Exposure Routes:	
Total Kidney HI =	0.04
Inhalation Exposure Routes:	
Inhalation Kidney HI =	0.00E+00
Inhalation Liver HI =	0.00E+00
Inhalation Respiratory System HI =	0.00E+00

Total Hazard Index Across Surface Soil	0.04
Total Hazard Index Across Groundwater	0.02
Total Hazard Index Across All Media and All Exposure Routes	0.06
Oral and Dermal Exposure Routes:	
Oral / Dermal Whole Body HI =	0.01
Oral / Dermal Kidney HI =	0.00
Oral / Dermal Liver HI =	0.01

TABLE 10.1.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Tetrachloroethene (PCE)	1.4E-04	--	8.2E-05	--	2.19E-04					
			Chemical Total	1.4E-04	--	8.2E-05		2.19E-04					
		Exposure Point Total						2.19E-04					
		Exposure Medium Total						2.19E-04					
	Air	Water Vapors	Tetrachloroethene (PCE)	--	5.1E-06	--	--	5.07E-06					
			Chemical Total	--	5.1E-06	--		5.07E-06					
		Exposure Point Total						5.07E-06					
		Exposure Medium Total						5.07E-06					
	Groundwater Total							2.24E-04					
	Adult Residents Total							2.24E-04					

Total Risk Across Groundwater 2.2E-04
Total Risk Across All Media and All Exposure Routes 2.2E-04

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TABLE 10.1.CT
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Tetrachloroethene (PCE)	1.9E-05	--	1.0E-05	--	2.92E-05					
			Chemical Total	1.9E-05	--	1.0E-05		2.92E-05					
			Exposure Point Total					2.92E-05					
		Exposure Medium Total						2.92E-05					
	Air	Water Vapors	Tetrachloroethene (PCE)	--	6.9E-07	--	--	6.92E-07					
			Chemical Total	--	6.9E-07	--		6.92E-07					
			Exposure Point Total					6.92E-07					
		Exposure Medium Total						6.92E-07					
	Groundwater Total								2.98E-05				
	Adult Residents Total								2.98E-05				

Total Risk Across Groundwater 3.0E-05
Total Risk Across All Media and All Exposure Routes 3.0E-05

TABLE 10.2.RME
 RISK ASSESSMENT SUMMARY
 REASONABLE MAXIMUM EXPOSURE
 SWMU 336
 RCRA FACILITY INVESTIGATION (CTO-0091)
 MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
 Receptor Population: Residents
 Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Tetrachloroethene (PCE)	8.0E-05	--	4.6E-05	--	1.26E-04					
			Chemical Total	8.0E-05	--	4.6E-05		1.26E-04					
		Exposure Point Total						1.26E-04					
		Exposure Medium Total						1.26E-04					
	Groundwater Total												
Young Child Residents Total													

Total Risk Across Groundwater 1.3E-04
 Total Risk Across All Media and All Exposure Routes 1.3E-04

TABLE 10.2.CT
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091)
MCB CAMP LEJEUNE, NORTH CAROLINA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap	Tetrachloroethene (PCE)	1.8E-05	--	5.9E-06	--	2.37E-05					
			Chemical Total	1.8E-05	--	5.9E-06		2.37E-05					
		Exposure Point Total							2.37E-05				
		Exposure Medium Total							2.37E-05				
	Groundwater Total								2.37E-05				
Young Child Residents Total								2.37E-05					

Total Risk Across Groundwater 2.4E-05
Total Risk Across All Media and All Exposure Routes 2.4E-05

Statistical Summaries

APPENDIX G

CURRENT SURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Cadmium
Raw Statistics	
Number of Observations	6
Number of Missing Data	0
Number of Valid Observations	6
Number of Distinct Observations	6
Minimum	0.045
Maximum	4.4
Mean	1.1925
Standard Deviation	1.697361924
Variance	2.8810375
Coefficient of Variation	1.423364297
Skewness	1.806530288
Too Few Distinct Observations?	NO
Normal Statistics	
Lilliefors Test Statistic	N/R
Lilliefors 5% Critical Value	N/R
Shapiro-Wilk Test Statistic	0.748181745
Shapiro-Wilk 5% Critical Value	0.788
5% Normality Test Result	NOT NORMAL
95% Student's-t UCL	2.588817807
Gamma Statistics	
k hat	0.614858074
k star (bias corrected)	0.418540148
Theta hat	1.939471971
Theta star	2.849189035
nu hat	7.378296883
nu star	5.022481775
5% Approximate Chi Square Value	1.162183787
Adjusted Level of Significance	0.01222
Adjusted Chi Square Value	0.625627751
Anderson-Darling Test Statistic	0.286653269
Anderson-Darling 5% Critical Value	0.729022836
Anderson-Darling 5% Gamma Test Result	AD GAMMA
Kolmogrov-Smirnov Test Statistic	0.2300182
Kolmogrov-Smirnov 5% Critical Value	0.346239329
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA
5% Gamma Test Result	GAMMA
95% Approximate Gamma UCL	5.153496015
95% Adjusted Gamma UCL	9.573279802
Lognormal Statistics	
Minimum of log data	-3.101092789
Maximum of log data	1.481604541
Mean of log data	-0.825250796
Standard Deviation of log data	1.666941778
Variance of log data	2.77869489

APPENDIX G (Continued)

CURRENT SURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Cadmium
Lognormal Statistics (Cont)	
Lilliefors Test Statistic	N/R
Lilliefors 5% Critical Value	N/R
Shapiro-Wilk Test Statistic	0.983515855
Shapiro-Wilk 5% Critical Value	0.788
5% Lognormality Test Result	LOGNORMAL
MLE Mean	1.757859102
MLE Standard Deviation	6.830362256
MLE Coefficient of Variation	3.885614183
MLE Skewness	70.32183606
MLE Median	0.438125099
MLE 80% Quantile	1.791968984
MLE 90% Quantile	3.73134735
MLE 95% Quantile	6.799631559
MLE 99% Quantile	21.15879755
MVU Estimate of Median	0.344713247
MVU Estimate of Mean	1.206581053
MVU Estimate of Standard Deviation	1.975808145
MVU Estimate of SE of Mean	0.756743035
95% H-UCL	276.8550354
95% Chebyshev (MVUE) UCL	4.505147469
97.5% Chebyshev (MVUE) UCL	5.932439792
99% Chebyshev (MVUE) UCL	8.736079183
Non-parametric Statistics	
95% CLT UCL	2.332293268
95% Adjusted-CLT UCL	2.878363958
95% Modified-t UCL	2.673993799
95% Jackknife UCL	2.588817807
95% Chebyshev (Mean, Sd) UCL	4.21297768
97.5% Chebyshev (Mean, Sd) UCL	5.519940785
99% Chebyshev (Mean, Sd) UCL	8.087216727
Bootstrap Statistics	
Number of Bootstrap Runs	2000
95% Standard Bootstrap UCL	2.210849835
95% Bootstrap-t UCL	11.25388115
95% Hall's Bootstrap UCL	9.039145204
95% Percentile Bootstrap UCL	2.2975
95% BCA Bootstrap UCL	2.663333333
Recommendations	
Human Inspection Recommended?	YES
Appropriate Distribution	GAMMA
1st Recommended UCL	5.153496015
UCL Test	95% Approximate Gamma UCL
2nd Recommended UCL	
3rd Recommended UCL	
Recommended UCL > Max Data Value	YES
Recommendation Warning!	NONE
Alternative UCL	NONE

APPENDIX G (Continued)

FUTURE SURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Cadmium
Raw Statistics	
Number of Observations	7
Number of Missing Data	0
Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	0.025
Maximum	4.4
Mean	1.025714286
Standard Deviation	1.611082526
Variance	2.595586905
Coefficient of Variation	1.57069327
Skewness	1.990942523
Too Few Distinct Observations?	NO
Normal Statistics	
Lilliefors Test Statistic	N/R
Lilliefors 5% Critical Value	N/R
Shapiro-Wilk Test Statistic	0.702026299
Shapiro-Wilk 5% Critical Value	0.803
5% Normality Test Result	NOT NORMAL
95% Student's-t UCL	2.208978437
Gamma Statistics	
k hat	0.503652001
k star (bias corrected)	0.383039239
Theta hat	2.03655358
Theta star	2.677830838
nu hat	7.051128016
nu star	5.362549342
5% Approximate Chi Square Value	1.322837378
Adjusted Level of Significance	0.01584
Adjusted Chi Square Value	0.812994522
Anderson-Darling Test Statistic	0.314864245
Anderson-Darling 5% Critical Value	0.751315037
Anderson-Darling 5% Gamma Test Result	AD GAMMA
Kolmogrov-Smirnov Test Statistic	0.205088188
Kolmogrov-Smirnov 5% Critical Value	0.327173095
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA
5% Gamma Test Result	GAMMA
95% Approximate Gamma UCL	4.158064748
95% Adjusted Gamma UCL	6.765658708
Lognormal Statistics	
Minimum of log data	-3.688879454
Maximum of log data	1.481604541
Mean of log data	-1.234340604
Standard Deviation of log data	1.867367231
Variance of log data	3.487060374

APPENDIX G (Continued)

FUTURE SURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Cadmium
Lognormal Statistics (Cont)	
Lilliefors Test Statistic	N/R
Lilliefors 5% Critical Value	N/R
Shapiro-Wilk Test Statistic	0.970751716
Shapiro-Wilk 5% Critical Value	0.803
5% Lognormality Test Result	LOGNORMAL
MLE Mean	1.663942161
MLE Standard Deviation	9.366931923
MLE Coefficient of Variation	5.629361491
MLE Skewness	195.2809221
MLE Median	0.291026601
MLE 80% Quantile	1.409992952
MLE 90% Quantile	3.206648424
MLE 95% Quantile	6.280681477
MLE 99% Quantile	22.40211948
MVU Estimate of Median	0.224982531
MVU Estimate of Mean	1.05807375
MVU Estimate of Standard Deviation	2.061942722
MVU Estimate of SE of Mean	0.700308867
95% H-UCL	207.1441603
95% Chebyshev (MVUE) UCL	4.110649332
97.5% Chebyshev (MVUE) UCL	5.431501225
99% Chebyshev (MVUE) UCL	8.026059001
Non-parametric Statistics	
95% CLT UCL	2.027318226
95% Adjusted-CLT UCL	2.516937926
95% Modified-t UCL	2.285349216
95% Jackknife UCL	2.208978437
95% Chebyshev (Mean, Sd) UCL	3.679987153
97.5% Chebyshev (Mean, Sd) UCL	4.828493143
99% Chebyshev (Mean, Sd) UCL	7.084510767
Bootstrap Statistics	
Number of Bootstrap Runs	2000
95% Standard Bootstrap UCL	1.934901828
95% Bootstrap-t UCL	8.976835823
95% Hall's Bootstrap UCL	7.515024744
95% Percentile Bootstrap UCL	2.02
95% BCA Bootstrap UCL	2.29
Recommendations	
Human Inspection Recommended?	NO
Appropriate Distribution	GAMMA
1st Recommended UCL	4.158064748
UCL Test	95% Approximate Gamma UCL
2nd Recommended UCL	
3rd Recommended UCL	
Recommended UCL > Max Data Value	
Recommendation Warning!	NONE
Alternative UCL	NONE

APPENDIX G (Continued)

SUBSURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	1,2,3-Trichlorobenzene	4-Isopropyltoluene
Raw Statistics		
Number of Observations	8	8
Number of Missing Data	0	0
Number of Valid Observations	8	8
Number of Distinct Observations	8	5
Minimum	0.65	1.17
Maximum	3.21	32
Mean	2.5075	5.07
Standard Deviation	0.997221139	10.8814311
Variance	0.99445	118.4055429
Coefficient of Variation	0.39769537	2.146238876
Skewness	-1.453234374	2.828356524
Too Few Distinct Observations?	NO	NO
Normal Statistics		
Lilliefors Test Statistic	N/R	N/R
Lilliefors 5% Critical Value	N/R	N/R
Shapiro-Wilk Test Statistic	0.715983017	0.421904955
Shapiro-Wilk 5% Critical Value	0.818	0.818
5% Normality Test Result	NOT NORMAL	NOT NORMAL
95% Student's-t UCL	3.175473274	12.35875961
Gamma Statistics		
k hat	4.375677485	0.607867889
k star (bias corrected)	2.818131761	0.463250764
Theta hat	0.573054118	8.340628107
Theta star	0.889773869	10.94439641
nu hat	70.01083976	9.725886223
nu star	45.09010818	7.412012223
5% Approximate Chi Square Value	30.68411377	2.398801882
Adjusted Level of Significance	0.01946	0.01946
Adjusted Chi Square Value	27.71091406	1.742069674
Anderson-Darling Test Statistic	1.315716008	2.47970586
Anderson-Darling 5% Critical Value	0.718757839	0.75493143
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	NOT AD GAMMA
Kolmogrov-Smirnov Test Statistic	0.394530591	0.536998498
Kolmogrov-Smirnov 5% Critical Value	0.295296189	0.306862845
Kolmogrov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	NOT KS GAMMA
5% Gamma Test Result	NOT GAMMA	NOT GAMMA
95% Approximate Gamma UCL	3.684755151	15.66569639
95% Adjusted Gamma UCL	4.080105262	21.5714116
Lognormal Statistics		
Minimum of log data	-0.430782916	0.157003749
Maximum of log data	1.166270937	3.465735903
Mean of log data	0.800688023	0.608824037
Standard Deviation of log data	0.595696036	1.15479753
Variance of log data	0.354853768	1.333557336

APPENDIX G (Continued)

SUBSURFACE SOIL STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	1,2,3-Trichlorobenzene	4-Isopropyltoluene
Lognormal Statistics (Cont)		
Lilliefors Test Statistic	N/R	N/R
Lilliefors 5% Critical Value	N/R	N/R
Shapiro-Wilk Test Statistic	0.674410663	0.444270291
Shapiro-Wilk 5% Critical Value	0.818	0.818
5% Lognormality Test Result	NOT LOGNORMAL	NOT LOGNORMAL
MLE Mean	2.659438224	3.580858962
MLE Standard Deviation	1.735723294	5.986054335
MLE Coefficient of Variation	0.652665393	1.671681124
MLE Skewness	2.236013438	9.686585997
MLE Median	2.227072678	1.838268392
MLE 80% Quantile	3.684191776	4.877476377
MLE 90% Quantile	4.788213749	8.107088996
MLE 95% Quantile	5.933462881	12.28606845
MLE 99% Quantile	8.902009189	26.97426039
MVU Estimate of Median	2.178103869	1.689932929
MVU Estimate of Mean	2.594398869	3.186726706
MVU Estimate of Standard Deviation	1.570316987	3.869296169
MVU Estimate of SE of Mean	0.553551654	1.327178626
95% H-UCL	4.735703224	19.69027477
95% Chebyshev (MVUE) UCL	5.007274588	8.971764218
97.5% Chebyshev (MVUE) UCL	6.051327839	11.47495457
99% Chebyshev (MVUE) UCL	8.102168283	16.3919873
Non-parametric Statistics		
95% CLT UCL	3.087427548	11.39802637
95% Adjusted-CLT UCL	2.893866678	15.50867728
95% Modified-t UCL	3.145281689	12.99993808
95% Jackknife UCL	3.175473274	12.35875961
95% Chebyshev (Mean, Sd) UCL	4.044320988	21.83941157
97.5% Chebyshev (Mean, Sd) UCL	4.709304658	29.09554935
99% Chebyshev (Mean, Sd) UCL	6.01553631	43.34882695
Bootstrap Statistics		
Number of Bootstrap Runs	2000	2000
95% Standard Bootstrap UCL	3.041158911	10.87376121
95% Bootstrap-t UCL	3.000108931	1371.185602
95% Hall's Bootstrap UCL	2.89570566	650.3715818
95% Percentile Bootstrap UCL	3.035	12.7575
95% BCA Bootstrap UCL	3.0025	12.77875
Recommendations		
Human Inspection Recommended?	YES	YES
Appropriate Distribution	NON-PARAMETRIC	NON-PARAMETRIC
1st Recommended UCL	4.044320988	43.34882695
UCL Test	95% Chebyshev (Mean, Sd) UCL	99% Chebyshev (Mean, Sd) UCL
2nd Recommended UCL		
3rd Recommended UCL		
Recommended UCL > Max Data Value	YES	YES
Recommendation Warning!	NONE	NONE
Alternative UCL	NONE	YES

APPENDIX G (Continued)

GROUNDWATER STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Tetrachloroethene (PCE)	1,2,3-Trichlorobenzene	Naphthalene
Raw Statistics			
Number of Observations	15	9	9
Number of Missing Data	0	0	0
Number of Valid Observations	15	9	9
Number of Distinct Observations	6	3	5
Minimum	0.5	0.52	0.85
Maximum	27	2.5	5
Mean	3.953333333	2.083333333	2.305555556
Standard Deviation	7.207918926	0.828462431	1.22944206
Variance	51.95409524	0.68635	1.511527778
Coefficient of Variation	1.823250993	0.397661967	0.533251978
Skewness	2.774316952	-1.637366125	1.171569805
Too Few Distinct Observations?	NO	NO	NO
Normal Statistics			
Lilliefors Test Statistic	N/R	N/R	N/R
Lilliefors 5% Critical Value	N/R	N/R	N/R
Shapiro-Wilk Test Statistic	0.559704642	0.551402666	0.819256392
Shapiro-Wilk 5% Critical Value	0.881	0.829	0.829
5% Normality Test Result	NOT NORMAL	NOT NORMAL	NOT NORMAL
95% Student's-t UCL	7.231266304	2.596855227	3.067624408
Gamma Statistics			
k hat	0.581015909	4.037366874	4.061882973
k star (bias corrected)	0.509257172	2.76565199	2.781996056
Theta hat	6.804173983	0.516012886	0.567607578
Theta star	7.762940911	0.753288317	0.82874149
nu hat	17.43047728	72.67260373	73.11389351
nu star	15.27771515	49.78173582	50.075929
5% Approximate Chi Square Value	7.453915039	34.5793424	34.82488515
Adjusted Level of Significance	0.03235	0.02308	0.02308
Adjusted Chi Square Value	6.790271363	31.92732007	32.162641
Anderson-Darling Test Statistic	1.909085683	2.193623318	0.720635936
Anderson-Darling 5% Critical Value	0.787195742	0.724877793	0.724823858
Anderson-Darling 5% Gamma Test Result	NOT AD GAMMA	NOT AD GAMMA	AD GAMMA
Kolmogorov-Smirnov Test Statistic	0.360399496	0.483885308	0.296182642
Kolmogorov-Smirnov 5% Critical Value	0.232646612	0.280407954	0.280393489
Kolmogorov-Smirnov 5% Gamma Test Result	NOT KS GAMMA	NOT KS GAMMA	NOT KS GAMMA
5% Gamma Test Result	NOT GAMMA	NOT GAMMA	APPROX GAMMA
95% Approximate Gamma UCL	8.102842635	2.999245862	3.315239542
95% Adjusted Gamma UCL	8.894769788	3.248376293	3.589656593
Lognormal Statistics			
Minimum of log data	-0.693147181	-0.653926467	-0.16251893
Maximum of log data	3.295836866	0.916290732	1.609437912
Mean of log data	0.306035819	0.605044212	0.707204987
Standard Deviation of log data	1.390647877	0.623405679	0.550750607
Variance of log data	1.933901518	0.388634641	0.303326232

APPENDIX G (Continued)

GROUNDWATER STATISTICAL SUMMARY - ProUCL RESULTS

SWMU 336

RCRA INVESTIGATION - CTO-0091

MCB, CAMP LEJEUNE, NORTH CAROLINA

Variable:	Tetrachloroethene (PCE)	1,2,3-Trichlorobenzene	Naphthalene
Lognormal Statistics (Cont)			
Lilliefors Test Statistic	N/R	N/R	N/R
Lilliefors 5% Critical Value	N/R	N/R	N/R
Shapiro-Wilk Test Statistic	0.74475304	0.563723643	0.872594775
Shapiro-Wilk 5% Critical Value	0.881	0.829	0.829
5% Lognormality Test Result	NOT LOGNORMAL	NOT LOGNORMAL	LOGNORMAL
MLE Mean	3.57150322	2.224120447	2.360487351
MLE Standard Deviation	8.687230851	1.532813663	1.405146841
MLE Coefficient of Variation	2.432373797	0.689177452	0.595278276
MLE Skewness	21.68812059	2.394867911	1.996775392
MLE Median	1.358030948	1.831333175	2.028314163
MLE 80% Quantile	4.397926916	3.101301962	3.230345992
MLE 90% Quantile	8.109355056	4.080095969	4.116155172
MLE 95% Quantile	13.37853526	5.106665026	5.018794351
MLE 99% Quantile	34.49046056	7.807507898	7.302749341
MVU Estimate of Median	1.272915836	1.792133048	1.994363646
MVU Estimate of Mean	3.200908377	2.170367607	2.316950102
MVU Estimate of Standard Deviation	5.54433267	1.386119304	1.300721165
MVU Estimate of SE of Mean	1.302712402	0.460207727	0.432491239
95% H-UCL	12.69336409	3.868799096	3.755312386
95% Chebyshev (MVUE) UCL	8.879300088	4.176366583	4.202135705
97.5% Chebyshev (MVUE) UCL	11.33634472	5.044363942	5.017857022
99% Chebyshev (MVUE) UCL	16.16273311	6.749376677	6.620183593
Non-parametric Statistics			
95% CLT UCL	7.014532036	2.537566479	2.979639633
95% Adjusted-CLT UCL	8.439007994	2.376518038	3.150646732
95% Modified-t UCL	7.453455767	2.571734925	3.09429806
95% Jackknife UCL	7.231266304	2.596855227	3.067624408
95% Chebyshev (Mean, Sd) UCL	12.06557844	3.287061339	4.091893454
97.5% Chebyshev (Mean, Sd) UCL	15.57575337	3.807915408	4.864843289
99% Chebyshev (Mean, Sd) UCL	22.47081233	4.831032371	6.383153569
Bootstrap Statistics			
Number of Bootstrap Runs	2000	2000	2000
95% Standard Bootstrap UCL	6.952849568	N/R	2.939346595
95% Bootstrap-t UCL	15.50969418	N/R	3.244166433
95% Hall's Bootstrap UCL	19.64203082	N/R	4.04230056
95% Percentile Bootstrap UCL	7.233333333	N/R	2.966666667
95% BCA Bootstrap UCL	9.12	N/R	3.044444444
Recommendations			
Human Inspection Recommended?	NO	YES	NO
Appropriate Distribution	NON-PARAMETRIC	NON-PARAMETRIC	GAMMA
1st Recommended UCL	22.47081233	3.287061339	3.315239542
UCL Test	99% Chebyshev (Mean, Sd) UCL	95% Chebyshev (Mean, Sd) UCL	95% Approximate Gamma UCL
2nd Recommended UCL			
3rd Recommended UCL			
Recommended UCL > Max Data Value		YES	
Recommendation Warning!	NONE	NONE	NONE
Alternative UCL	NONE	NONE	NONE

Human Health Risk Calculation Spread Sheets

ADULT MILITARY BASE PERSONNEL - CURRENT SCENARIO
 ACCIDENTAL INGESTION OF SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	5.15	NA	5.0E-04	2.9E-07	--	--	5.0E-06	1.0E-02	100.0%
				Total ILCR:	--	--	Total HI:	1.0E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT MILITARY BASE PERSONNEL - CURRENT SCENARIO
 DERMAL CONTACT WITH SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{DAD (mg/kg/d)} = (\text{C} \cdot \text{CF} \cdot \text{AF} \cdot \text{ABS} \cdot \text{SA} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSFd}$$

$$\text{HQ} = \text{CDI} / \text{RfDd}$$

Parameter	Units	Description	Adult	(Chemical Specific)
DAD	mg/kg/d	Dermally absorbed dose	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	(1)	
SA	cm2/day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	Carcinogens			Noncarcinogens		
					DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Cadmium	5.15	0.001	NA	2.5E-05	1.9E-09	--	--	3.3E-08	1.3E-03	100.0%
Total ILCR:					--	--	--	Total HI:	1.3E-03	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT MILITARY BASE PERSONNEL - CURRENT SCENARIO
 INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (Ca * RR * ET * EF * ED) / (BW * AT)$$

Where: $Ca = C * (1/PEF)$

$$ILCR = CDI * CSFi$$

$$HQ = CDI / RfDi$$

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	
RR	m3/hour	Respiration rate	0.55	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	4	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	1,460	

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Carcinogens			Noncarcinogens		
					CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	5.15	3.90E-09	6.3E+00	NA	9.6E-12	6.1E-11	100.0%	1.7E-10	--	--
					Total ILCR:	6.1E-11	100.0%	Total HI:	--	--

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADOLESCENT TRESPASSERS - FUTURE SCENARIO
 ACCIDENTAL INGESTION OF SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adolescent	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	100	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	52	
ED	years	Exposure duration	10	
BW	kg	Body weight	45	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	3,650	

Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Adolescent					
				Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	NA	5.0E-04	1.9E-07	--	--	1.3E-06	2.6E-03	100.0%
Total ILCR:				--	--	--	Total HI:	2.6E-03	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADOLESCENT TRESPASSERS - FUTURE SCENARIO
 DERMAL CONTACT WITH SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{DAD (mg/kg/d)} = (\text{C} \cdot \text{CF} \cdot \text{AF} \cdot \text{ABS} \cdot \text{SA} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSFd}$$

$$\text{HQ} = \text{CDI} / \text{RfDd}$$

Parameter	Units	Description	Adolescent
DAD	mg/kg/d	Dermally absorbed dose	CS (Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS
HQ	NA	Hazard quotient	CS
RfDd	mg/kg/d	Dermal reference dose	CS
C	mg/kg	Concentration of chemical in soil	CS
CF	kg/mg	Conversion factor	1.00E-06
AF	mg/cm2	Soil to skin adherence factor	0.2
ABS	NA	Absorption fraction	(1)
SA	cm2/day	Skin surface area available for contact	5,300
EF	days/year	Exposure frequency	52
ED	years	Exposure duration	10
BW	kg	Body weight	45
AT-C	days	Averaging time, carcinogens	25,550
AT-N	days	Averaging time, noncarcinogens	3,650

Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	Adolescent					
					Carcinogens			Noncarcinogens		
					DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	0.001	NA	2.5E-05	2.0E-09	--	--	1.4E-08	5.6E-04	100.0%
Total ILCR:					--	--	--	Total HI:	5.6E-04	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADOLESCENT TRESPASSERS - FUTURE SCENARIO
 INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (Ca * RR * ET * EF * ED) / (BW * AT)$$

Where: $Ca = C * (1/PEF)$

$$ILCR = CDI * CSFi$$

$$HQ = CDI / RfDi$$

Parameter	Units	Description	Adolescent
CDI	mg/kg/d	Chronic daily intake	CS (Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS
HQ	NA	Hazard quotient	CS
RfDi	mg/kg/d	Inhalation reference dose	CS
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS
C	mg/kg	Concentration of chemical in soil	CS
PEF	m3/kg	Particulate emission factor	1.32E+09
RR	m3/hour	Respiration rate	0.58
ET	hours/day	Exposure time	4.0
EF	days/year	Exposure frequency	52
ED	years	Exposure duration	10
BW	kg	Body weight	45
AT-C	days	Averaging time, carcinogens	25,550
AT-N	days	Averaging time, noncarcinogens	3,650

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Adolescent					
					Carcinogens			Noncarcinogens		
					CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	3.15E-09	6.3E+00	NA	3.3E-12	2.1E-11	100.0%	2.3E-11	--	--
Total ILCR:					2.1E-11	100.0%	Total HI:	--	--	--

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 ACCIDENTAL INGESTION OF SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI (mg/kg/d) = (C * IR * CF * FI * EF * ED) / (BW * AT)$$

$$ILCR = CDI * CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	Young Child	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of soil	100	200	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	

Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	NA	5.0E-04	2.0E-06	--	--	5.7E-06	1.1E-02	100.0%	4.6E-06	--	--	5.3E-05	1.1E-01	100.0%
				Total ILCR:	--	--	Total HI:	1.1E-02	100.0%	Total ILCR:	--	--	Total HI:	1.1E-01	100.0%

NOTES:

-- - Not applicable.
 NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 DERMAL CONTACT WITH SURFACE SOIL - SWMU 334
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{DAD (mg/kg/d)} = (\text{C} \cdot \text{CF} \cdot \text{AF} \cdot \text{ABS} \cdot \text{SA} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSFd}$$

$$\text{HQ} = \text{CDI} / \text{RfDd}$$

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm2	Soil to skin adherence factor	0.07	0.2	
ABS	NA	Absorption fraction	(1)	(1)	
SA	cm2/day	Skin surface area available for contact	5,700	2,800	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	

Parameter	C (mg/kg)	ABS	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
					DAD (mg/kg/d)	% Contrib. ILCR	Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	% Contrib. ILCR	Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	0.001	NA	2.5E-05	7.8E-09	--	--	2.3E-08	9.1E-04	100.0%	1.3E-08	--	--	1.5E-07	6.0E-03	100.0%
Total ILCR:					--	--	--	Total HI:	9.1E-04	100.0%	Total ILCR:	--	--	Total HI:	6.0E-03	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SWMU 33/
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (Ca \cdot RR \cdot ET \cdot EF \cdot ED) / (BW \cdot AT)$$

Where: $Ca = C \cdot (1/PEF)$

$$ILCR = CDI \cdot CSFi$$

$$HQ = CDI / RfDi$$

Parameter	Units	Description	Adult	Young Child	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	1.32E+09	
RR	m3/hour	Respiration rate	0.55	0.31	
ET	hours/day	Exposure time	1.5	5.6	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
					CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	3.15E-09	6.3E+00	NA	1.2E-11	7.7E-11	100.0%	3.6E-11	--	--	3.0E-11	1.9E-10	100.0%	3.5E-10	--	--
Total ILCR:					7.7E-11		100.0%	Total HI:	--	--	Total ILCR:	1.9E-10	100.0%	Total HI:	--	--

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 336
REASONABLE MAXIMUM EXPOSURE
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLIN

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	Young Child	
CDI	mg/kg/d	Chronic daily intake	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/L	Concentration of chemical in water	CS	CS	
IR-W	L/day	Ingestion rate of water	2	1	
EF	days/year	Exposure frequency	350	350	
ED	years	Exposure duration	24	6	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	2,190	

Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	NA	1.0E-02	6.9E-06	--	--	2.0E-05	2.0E-03	2.4%	4.0E-06	--	--	4.7E-05	4.7E-03	2.4%
Naphthalene	0.005	NA	2.0E-02	4.7E-05	--	--	1.4E-04	6.8E-03	8.3%	2.7E-05	--	--	3.2E-04	1.6E-02	8.3%
Tetrachloroethene (PCE)	0.027	5.4E-01	1.0E-02	2.5E-04	1.4E-04	100.0%	7.4E-04	7.4E-02	89.3%	1.5E-04	8.0E-05	100.0%	1.7E-03	1.7E-01	89.3%
Total ILCR:				1.4E-04		100.0%	Total HI:	8.3E-02	100.0%	Total ILCR:	8.0E-05	100.0%	Total HI:	1.9E-01	100.0%

NOTES:

-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 DERMAL CONTACT WITH GROUNDWATER - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTD-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\begin{aligned} \text{DAD (mg/kg/d)} &= (C \cdot CF \cdot K_p \cdot SA \cdot EF \cdot ED \cdot ET) / (BW \cdot AT) \\ \text{DAD (mg/kg/d)} &= (C \cdot CF \cdot (2 \cdot K_p \cdot \text{SQRT}(6 \cdot \tau \cdot ET \cdot \pi)) \cdot SA \cdot EF \cdot ED) / (BW \cdot AT) \\ \text{DAD (mg/kg/d)} &= (C \cdot CF \cdot (K_p \cdot (ET \cdot (1+B) - 2 \cdot \tau \cdot ((1+3 \cdot B) \cdot (1+B)))) \cdot SA \cdot EF \cdot ED) / (BW \cdot A) \end{aligned}$$

Inorganics
 $ET \leq 1^*$ (Organics)
 $ET > 1^*$ (Benzene & Vinyl Chloride)

ILCR = $CDI \cdot CSF \cdot Adj$
 $HQ = CDI / RfD \cdot Adj$

$CSF Adj = CSF / AD$
 $RfD Adj = RfD \cdot AD$

Parameter	Units	Description	Adult	Young Child
DAD	mg/kg/d	Dermally absorbed dose	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSF _d	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfD _d	mg/kg/d	Dermal reference dose	CS	CS
SA	cm ²	Skin surface area available for contact	18,000	6,600
EF	days/year	Exposure frequency	350	350
ED	years	Exposure duration	24	6
ET	hours/day	Exposure time	0.58	1.00
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	8,760	2,190
C	mg/L	Concentration of chemical in water	CS	CS
CF	L/cm ³	Conversion factor	1.00E-03	1.00E-03
K _p	cm/hour	Dermal permeability coefficient	CS	CS
AD	NA	Adjustment for absorbed dose	CS	CS

Parameter	C (mg/L)	K _p (cm/hour)	tau (hours)	1* (hours)	B	CSF _d 1/(mg/kg/d)	RfD _d (mg/kg/d)	Adult			Young Child								
								Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
								DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	0.071927	1.11 ⁽¹⁾	2.66 ⁽¹⁾	0.3 ⁽¹⁾	NA	1.0E-02	9.8E-06	--	--	2.9E-05	2.9E-03	5.6%	5.5E-06	--	--	6.5E-05	6.5E-03	5.6%
Naphthalene	0.005	0.047	0.56	1.34	0.2	NA	2.0E-02	3.1E-05	--	--	9.1E-05	4.6E-03	8.9%	1.8E-05	--	--	2.1E-04	1.0E-02	8.9%
Tetrachloroethene (PCE)	0.027	0.033	0.91	2.18	0.2	5.4E-01	1.0E-02	1.5E-04	8.2E-05	100.0%	4.4E-04	4.4E-02	85.6%	8.5E-05	4.6E-05	100.0%	9.9E-04	9.9E-02	85.6%
Total ILCR:								8.2E-05	100.0%		Total HI:	5.2E-02	100.0%	Total ILCR:	4.6E-05	100.0%	Total HI:	1.2E-01	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

(1) Value for 1,2,4-Trichlorobenzene

K_p, tau, 1*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT RESIDENTS - FUTURE SCENARIO
 INHALATION OF VOLATILES IN GROUNDWATER - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	(Chemical Sp
CDI	mg/kg/d	Chronic daily intake	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/day	Ingestion rate of water	2	
EF	days/year	Exposure frequency	350	
ED	years	Exposure duration	24	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	8,760	

Parameter	C (mg/L)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Adult					
				Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	NA	1.0E-03 ⁽¹⁾	6.9E-06	--	--	2.0E-05	2.0E-02	11.3%
Naphthalene	0.005	NA	9.0E-04	4.7E-05	--	--	1.4E-04	1.5E-01	85.8%
Tetrachloroethene (PCE)	0.027	2.0E-02	1.4E-01	2.5E-04	5.1E-06	100.0%	7.4E-04	5.3E-03	3.0%
Total ILCR:				5.1E-06	100.0%		Total HI:	1.8E-01	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

(1) Value for 1,2,4-Trichlorobenzene

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 ACCIDENTAL INGESTION OF SURFACE SOIL - SWMU 336
 CENTRAL TENDENCY
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{CDI (mg/kg/d)} = (\text{C} \cdot \text{IR} \cdot \text{CF} \cdot \text{FI} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSFo}$$

$$\text{HQ} = \text{CDI} / \text{RfDo}$$

Parameter	Units	Description	Adult	Young Child	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
IR-S	mg/day	Ingestion rate of soil	50	100	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	1	
EF	days/year	Exposure frequency	234	234	
ED	years	Exposure duration	7	2	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	2,555	730	

Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	NA	5.0E-04	1.9E-07	--	--	1.9E-06	3.8E-03	100.0%	5.1E-07	--	--	1.8E-05	3.6E-02	100.0%
Total ILCR:				--	--	--	Total HI:	3.8E-03	100.0%	Total ILCR:	--	--	Total HI:	3.6E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 DERMAL CONTACT WITH SURFACE SOIL - SWMU 33c
 CENTRAL TENDENCY
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{DAD (mg/kg/d)} = (\text{C} \cdot \text{CF} \cdot \text{AF} \cdot \text{ABS} \cdot \text{SA} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSF}_d$$

$$\text{HQ} = \text{CDI} / \text{RfD}_d$$

Parameter	Units	Description	Adult	Young Child	
DAD	mg/kg/d	Dermally absorbed dose	CS	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSF _d	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfD _d	mg/kg/d	Dermal reference dose	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
CF	kg/mg	Conversion factor	1.00E-06	1.00E-06	
AF	mg/cm ²	Soil to skin adherence factor	0.01	0.04	
ABS	NA	Absorption fraction	(1)	(1)	
SA	cm ² /day	Skin surface area available for contact	5,700	2,800	
EF	days/year	Exposure frequency	234	234	
ED	years	Exposure duration	7	2	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	2,555	730	

Parameter	C (mg/kg)	ABS	CSF _d 1/(mg/kg/d)	RfD _d (mg/kg/d)	Adult						Young Child					
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
					DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI	DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	0.001	NA	2.5E-05	2.2E-10	--	--	2.2E-09	8.7E-05	100.0%	5.7E-10	--	--	2.0E-08	8.0E-04	100.0%
Total ILCR:					--	--	--	Total HI:	8.7E-05	100.0%	Total ILCR:	--	--	Total HI:	8.0E-04	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SWMU 33:
 CENTRAL TENDENCY
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (Ca \cdot RR \cdot ET \cdot EF \cdot ED) / (BW \cdot AT)$$

Where: $Ca = C \cdot (1/PEF)$

$$ILCR = CDI \cdot CSF_i$$

$$HQ = CDI / RfDi$$

Parameter	Units	Description	Adult	Young Child	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	CS	
C	mg/kg	Concentration of chemical in soil	CS	CS	
PEF	m3/kg	Particulate emission factor	1.32E+09	1.32E+09	
RR	m3/hour	Respiration rate	0.55	0.31	
ET	hours/day	Exposure time	1.5	5.6	
EF	days/year	Exposure frequency	234	234	
ED	years	Exposure duration	7	2	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	2,555	730	

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Adult						Young Child							
					Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens				
					CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI		
Cadmium	4.16	3.15E-09	6.3E+00	NA	2.4E-12	1.5E-11	100.0%	2.4E-11	--	--	6.6E-12	4.2E-11	100.0%	2.3E-10	--	--		
Total ILCR:					1.5E-11	100.0%	Total HI:			--	--	Total ILCR:	4.2E-11	100.0%	Total HI:		--	--

NOTES:

- - Not applicable.
- NA - Toxicity criterion not available

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
INGESTION OF GROUNDWATER AS DRINKING WATER - SWMU 336
CENTRAL TENDENCY
POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLIN

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	Young Child	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	CS	
HQ	NA	Hazard quotient	CS	CS	
RfDo	mg/kg/d	Oral reference dose	CS	CS	
C	mg/L	Concentration of chemical in water	CS	CS	
IR-W	L/day	Ingestion rate of water	1.4	1	
EF	days/year	Exposure frequency	234	234	
ED	years	Exposure duration	7	2	
BW	kg	Body weight	70	15	
AT-C	days	Averaging time, carcinogens	25,550	25,550	
AT-N	days	Averaging time, noncarcinogens	2,555	730	

Parameter	C (mg/L)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Adult						Young Child					
				Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI	CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	NA	1.0E-02	9.4E-07	--	--	9.4E-06	9.4E-04	2.4%	8.9E-07	--	--	3.1E-05	3.1E-03	2.4%
Naphthalene	0.005	NA	2.0E-02	6.4E-06	--	--	6.4E-05	3.2E-03	8.3%	6.1E-06	--	--	2.1E-04	1.1E-02	8.3%
Tetrachloroethene (PCE)	0.027	5.4E-01	1.0E-02	3.5E-05	1.9E-05	100.0%	3.5E-04	3.5E-02	89.3%	3.3E-05	1.8E-05	100.0%	1.2E-03	1.2E-01	89.3%
Total ILCR:				1.9E-05		100.0%	Total HI:	3.9E-02	100.0%	Total ILCR:	1.8E-05	100.0%	Total HI:	1.3E-01	100.0%

NOTES:

-- - Not applicable.
NA - Toxicity criterion not available.

ADULT AND YOUNG CHILD RESIDENTS - FUTURE SCENARIO
 DERMAL CONTACT WITH GROUNDWATER - SWMU 336
 CENTRAL TENDENCY
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJUNE, NORTH CAROLINA

$$DAD \text{ (mg/kg/d)} = (C \cdot CF \cdot Kp \cdot SA \cdot EF \cdot ED \cdot ET) / (BW \cdot A)$$

$$DAD \text{ (mg/kg/d)} = (C \cdot CF \cdot (2 \cdot Kp \cdot \sqrt{6 \cdot \tau \cdot ET \cdot \pi})) \cdot SA \cdot EF \cdot ED / (BW \cdot A)$$

$$DAD \text{ (mg/kg/d)} = (C \cdot CF \cdot (Kp \cdot (ET \cdot (1+B) + 2 \cdot \tau \cdot ((1+3 \cdot B) \cdot (1+B)))) \cdot SA \cdot EF \cdot ED) / (BW \cdot A)$$

Inorganics

ET ≤ t* (Organics)

ET > t* (Benzene & Vinyl Chloride)

$$ILCR = CDI \cdot CSF \cdot Adj$$

$$HQ = CDI / RfD \cdot Adj$$

$$CSF \cdot Adj = CSF / AD$$

$$RfD \cdot Adj = RfD \cdot AD$$

Parameter	Units	Description	Adult	Young Child
DAD	mg/kg/d	Dermally absorbed dose	CS	CS
ILCR	NA	Incremental lifetime cancer risk	CS	CS
CSF	1/(mg/kg/d)	Dermal cancer slope factor	CS	CS
HQ	NA	Hazard quotient	CS	CS
RfD	mg/kg/d	Dermal reference dose	CS	CS
SA	cm ²	Skin surface area available for contact	18,000	6,600
EF	days/year	Exposure frequency	234	234
ED	years	Exposure duration	7	2
ET	hours/day	Exposure time	0.25	0.33
BW	kg	Body weight	70	15
AT-C	days	Averaging time, carcinogens	25,550	25,550
AT-N	days	Averaging time, noncarcinogens	2,555	730
C	mg/L	Concentration of chemical in water	CS	CS
CF	L/cm ³	Conversion factor	1.00E-03	1.00E-03
Kp	cm/hour	Dermal permeability coefficient	CS	CS
AD	NA	Adjustment for absorbed dose	CS	CS

Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	Adult						Young Child													
								Carcinogens			Noncarcinogens			Carcinogens			Noncarcinogens										
								DAD	ILCR	% Contrib. Total ILCR	DAD	HQ	% Contrib. HI	DAD	ILCR	% Contrib. Total ILCR	DAD	HQ	% Contrib. HI								
								(mg/kg/d)			(mg/kg/d)			(mg/kg/d)			(mg/kg/d)										
1,2,3-Trichlorobenzene	0.00073	0.071927	1.11 ⁽¹⁾	2.66 ⁽¹⁾	0.3 ⁽¹⁾	NA	1.0E-02	1.3E-06	--	--	1.3E-05	1.3E-03	5.6%	7.1E-07	--	--	2.5E-05	2.5E-03	5.6%								
Naphthalene	0.005	0.047	0.56	1.34	0.2	NA	2.0E-02	4.0E-06	--	--	4.0E-05	2.0E-03	8.9%	2.3E-06	--	--	7.9E-05	3.9E-03	8.9%								
Tetrachloroethene (PCE)	0.027	0.033	0.91	2.18	0.2	5.4E-01	1.0E-02	1.9E-05	1.0E-05	100.0%	1.9E-04	1.9E-02	85.6%	1.1E-05	5.9E-06	100.0%	3.8E-04	3.8E-02	85.6%								
Total ILCR:								1.0E-05	100.0%		Total HI:			2.3E-02	100.0%		Total ILCR:			5.9E-06	100.0%		Total HI:			4.4E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

(1) Value for 1,2,4-Trichlorobenzene

Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

ADULT RESIDENTS - FUTURE SCENARIO
 INHALATION OF VOLATILES IN GROUNDWATER - SWMU 336
 CENTRAL TENDENCY
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (C * IR * EF * ED) / (BW * AT)$$

$$ILCR = CDI * CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	(Chemical Sp)
CDI	mg/kg/d	Chronic daily intake	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/L	Concentration of chemical in water	CS	
IR-W	L/day	Ingestion rate of water	1.4	
EF	days/year	Exposure frequency	234	
ED	years	Exposure duration	7	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	2,555	

Parameter	C (mg/L)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Adult					
				Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	NA	1.0E-03 ⁽¹⁾	9.4E-07	--	--	9.4E-06	9.4E-03	11.3%
Naphthalene	0.005	NA	9.0E-04	6.4E-06	--	--	6.4E-05	7.1E-02	85.8%
Tetrachloroethene (PCE)	0.027	2.0E-02	1.4E-01	3.5E-05	6.9E-07	100.0%	3.5E-04	2.5E-03	3.0%
Total ILCR:				6.9E-07	100.0%		Total HI:	8.3E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

(1) Value for 1,2,4-Trichlorobenzene

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
 ACCIDENTAL INGESTION OF SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (C \cdot IR \cdot CF \cdot FI \cdot EF \cdot ED) / (BW \cdot AT)$$

$$ILCR = CDI \cdot CSFo$$

$$HQ = CDI / RfDo$$

Parameter	Units	Description	Adult	(Chemical Specific)
CDI	mg/kg/d	Chronic daily intake	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFo	1/(mg/kg/d)	Oral cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDo	mg/kg/d	Oral reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
IR-S	mg/day	Ingestion rate of soil	480	
CF	kg/mg	Conversion factor	1.00E-06	
FI	NA	Fraction of soil ingested from site	1	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

Parameter	C (mg/kg)	CSFo 1/(mg/kg/d)	RfDo (mg/kg/d)	Carcinogens			Noncarcinogens		
				CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	NA	5.0E-04	2.8E-07	--	--	2.0E-05	3.9E-02	100.0%
				Total ILCR:	--	--	Total HI:	3.9E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
 DERMAL CONTACT WITH SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$\text{DAD (mg/kg/d)} = (\text{C} \cdot \text{CF} \cdot \text{AF} \cdot \text{ABS} \cdot \text{SA} \cdot \text{EF} \cdot \text{ED}) / (\text{BW} \cdot \text{AT})$$

$$\text{ILCR} = \text{CDI} \cdot \text{CSF}_d$$

$$\text{HQ} = \text{CDI} / \text{RfD}_d$$

Parameter	Units	Description	Adult	(Chemical Specific)
DAD	mg/kg/d	Dermally absorbed dose	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSF _d	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfD _d	mg/kg/d	Dermal reference dose	CS	
C	mg/kg	Concentration of chemical in soil	CS	
CF	kg/mg	Conversion factor	1.00E-06	
AF	mg/cm ²	Soil to skin adherence factor	0.2	
ABS	NA	Absorption fraction	(1)	
SA	cm ² /day	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

Parameter	C (mg/kg)	ABS	CSF _d 1/(mg/kg/d)	RfD _d (mg/kg/d)	Carcinogens			Noncarcinogens		
					DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	0.001	NA	2.5E-05	3.8E-10	--	--	2.7E-08	1.1E-03	100.0%
Total ILCR:					--	--	--	Total HI:	1.1E-03	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
 INHALATION OF FUGITIVE DUSTS EMANATING FROM SURFACE SOIL - SWMU 336
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISKS
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$CDI \text{ (mg/kg/d)} = (Ca \cdot RR \cdot ET \cdot EF \cdot ED) / (BW \cdot AT)$$

Where: $Ca = C \cdot (1/PEF)$

$$ILCR = CDI \cdot CSFi$$

$$HQ = CDI / RfDi$$

Parameter	Units	Description	Adult	
CDI	mg/kg/d	Chronic daily intake	CS	(Chemical Specific)
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFi	1/(mg/kg/d)	Inhalation cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDi	mg/kg/d	Inhalation reference dose	CS	
Ca	mg/m3	Concentration of chemical in air as fugitive dusts	CS	
C	mg/kg	Concentration of chemical in soil	CS	
PEF	m3/kg	Particulate emission factor	2.77E+06	
RR	m3/hour	Respiration rate	3.30	
ET	hours/day	Exposure time	8.0	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogens	25,550	
AT-N	days	Averaging time, noncarcinogens	365	

Parameter	C (mg/kg)	Ca (mg/m3)	CSFi 1/(mg/kg/d)	RfDi (mg/kg/d)	Carcinogens			Noncarcinogens		
					CDI (mg/kg/d)	ILCR	% Contrib. Total ILCR	CDI (mg/kg/d)	HQ	% Contrib. HI
Cadmium	4.16	1.50E-06	6.3E+00	NA	5.5E-09	3.5E-08	100.0%	3.9E-07	--	--
					Total ILCR:	3.5E-08	100.0%	Total HI:	--	--

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available.

PARTICULATE EMISSION FACTOR - CONSTRUCTION WORKERS
SWMU 336
RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLINA

$$PEF = Q/C_{sr} \times 1/F_D \times \left[\frac{T \times A_R}{556 \times (W/3)^{0.4} \times (365-p)/365 \times \text{Sum(VKT)}} \right]$$

$$Q/C_{sr} = A \times \exp ((\ln A_S - B)^2/C)$$

Symbol	Definition (units)	Default	Reference
Q/C_{sr}	Inverse of a 1-h avg. air concentration along a straight road bisecting a 1.42 acre square site (g/m ² -s/kg/m ³)	19.4	USEPA 2001
A	Constant (unitless)	12.9351	USEPA 2001
A_S	Arial extent of site surface soil contamination (acres)	1.42	Site-specific
B	Constant (unitless)	5.7383	USEPA 2001
C	Constant (unitless)	71.7711	USEPA 2001
F_D	Dispersion correction factor	0.185	USEPA 2001
T	Total time over which construction occurs (s)	7.20E+06	USEPA 2001
A_R	Surface area of contaminated road segment (m ²)	1,155	Site-specific
W	Mean vehicle weight (tons)	8	USEPA 2001
p	Number of days with at least 0.01 inches of precipitation (days/year)	120	USEPA 2001
Sum(VKT)	Sum of fleet vehicle kilometers traveled during the exposure duration (km)	570	USEPA 2001
PEF	Particulate Emission Factor (m ³ /kg)	2.77E+06	Site-specific

Assumptions

W assumptions: 20 - 2-ton cars and 10 - 20-ton trucks = 30 vehicles

Sum(VKT) assumptions:

Assume that the site is 1.42 acres configured as a square with the unpaved road segment dividing the square evenly. The road length equals the square root of the 1.42 acres (0.076 km). Assume that each vehicle travels the length of the road 1 time per day, 5 days per week, for a total of 12 months (1 year) = 30 vehicles x 0.076 km/day x 50 weeks/yr x 5 days/week = 570 km

A_R assumptions:

Based on VKT, the road length is 76 m and assume the road width is 50 ft. (15.24).

Q/C _{sr} Calculation			
Ln A_S	0.351		
(Ln $A_S - B$) ²	29.0		
(Ln $A_S - B$) ² /C	0.404		
$e^{(\ln A_S - B)^2/C}$	1.50		
$A \times e^{(\ln A_S - B)^2/C}$	19.4	Q/C_{sr}	
PEF Calculation			
$Q/C_{sr} \times 1/F_D$	105		
$T \times A_R$	8,317,998,692		
$(W/3)^{0.4}$	1.48		
$(365-p)/365$	0.671		
$556 \times (W/3)^{0.4} \times (365-p)/365 \times \text{Sum(VKT)}$	314,927		
$T \times A_R / 556 \times (W/3)^{0.4} \times (365-p)/365 \times \text{Sum(VKT)}$	26,412		
PEF	2,767,261		
1.42 acres / 0.000247 acres / m ² =	5,749	m ²	
sqrt (5749) / 1000 =	0.076	km	

Reference

USEPA 2001. Draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

ADULT CONSTRUCTION WORKERS - FUTURE SCENARIO
 DERMAL CONTACT WITH GROUNDWATER - SWMU 33
 REASONABLE MAXIMUM EXPOSURE
 POTENTIAL CARCINOGENIC AND NONCARCINOGENIC RISK
 RCRA FACILITY INVESTIGATION (CTO-0091) - MCB CAMP LEJEUNE, NORTH CAROLIN

$$\text{DAD (mg/kg/d)} = (C \cdot CF \cdot K_p \cdot SA \cdot EF \cdot ED \cdot ET) / (BW \cdot AT)$$

$$\text{DAD (mg/kg/d)} = (C \cdot CF \cdot (2 \cdot K_p \cdot \text{SQRT}(6 \cdot \tau \cdot ET / \pi))) \cdot SA \cdot EF \cdot ED / (BW \cdot AT)$$

$$\text{DAD (mg/kg/d)} = (C \cdot CF \cdot (K_p \cdot (ET / (1 + B) + 2 \cdot \tau \cdot ((1 + 3 \cdot B) / (1 + B)))) \cdot SA \cdot EF \cdot ED) / (BW \cdot AT \cdot ET > \tau^* \text{ (Benzene \& Vinyl Chloride)}}$$

Inorganics
 $ET \leq \tau^*$ (Organics)

$$\text{ILCR} = \text{CDI} \cdot \text{CSFo Adj}$$

$$\text{HQ} = \text{CDI} / \text{RfDo Adj}$$

$$\text{CSF Adj} = \text{CSF} / \text{AD}$$

$$\text{RfD Adj} = \text{RfD} \cdot \text{AD}$$

Parameter	Units	Description	Adult	(Chemical Specific)
DAD	mg/kg/d	Dermally absorbed dose	CS	
ILCR	NA	Incremental lifetime cancer risk	CS	
CSFd	1/(mg/kg/d)	Dermal cancer slope factor	CS	
HQ	NA	Hazard quotient	CS	
RfDd	mg/kg/d	Dermal reference dose	CS	
SA	cm ²	Skin surface area available for contact	3,300	
EF	days/year	Exposure frequency	250	
ED	years	Exposure duration	1	
ET	hours/day	Exposure time	2.60	
BW	kg	Body weight	70	
AT-C	days	Averaging time, carcinogen	25,550	
AT-N	days	Averaging time, noncarcinogen	365	
C	mg/L	Concentration of chemical in water	CS	
CF	L/cm ³	Conversion factor	1.00E-03	
Kp	cm/hour	Dermal permeability coefficient	CS	
AD	NA	Adjustment for absorbed dose	CS	

Parameter	C (mg/L)	Kp (cm/hour)	tau (hours)	t* (hours)	B	CSFd 1/(mg/kg/d)	RfDd (mg/kg/d)	Carcinogens			Noncarcinogens		
								DAD (mg/kg/d)	ILCR	% Contrib. Total ILCR	DAD (mg/kg/d)	HQ	% Contrib. HI
1,2,3-Trichlorobenzene	0.00073	0.07192695	1.11 ⁽¹⁾	2.66 ⁽¹⁾	0.3 ⁽¹⁾	NA	1.0E-02 ⁽¹⁾	1.1E-07	--	--	8.0E-06	8.0E-04	5.2%
Naphthalene	0.005	0.047	0.56	1.34	0.2	NA	2.0E-02	4.0E-07	--	--	2.8E-05	1.4E-03	9.0%
Tetrachloroethene (PCE)	0.027	0.033	0.91	2.18	0.2	5.4E-01	1.0E-02	1.9E-06	1.0E-06	100.0%	1.3E-04	1.3E-02	85.8%
Total ILCR:								1.0E-06		100.0%	Total HI:	1.5E-02	100.0%

NOTES:

-- - Not applicable.

NA - Toxicity criterion not available

(1) Value for 1,2,4-Trichlorobenzene

Kp, tau, t*, and B values are derived from the USEPA RAGS E Guidance unless otherwise noted

Checklist for Ecological Assessment

CHECKLIST FOR ECOLOGICAL ASSESSMENTS/SAMPLING

I. SITE LOCATION

1. Site Name SWMU 336
US EPA ID Number NA
Location Marine Corps Base Camp Lejeune
County Onslow City Jacksonville State NC

2. Latitude 34°45'N Longitude 77°25'W

3. Attach site maps, including a topographical map, a diagram that illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps that illustrate known and suspected release areas, sampling locations and any other important features, if available.

Site maps are included within the main text of this report (RFI Report).

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft.)

SWMU 336 - Building AS-4106 approximately 100x40 feet. Drain from building floor drain extends approx 25 feet out from building (northwest). Study area includes building and soils above drainage pipes.

2. Is this the first site visit? ☒ Yes ☐ No *(first visit by ecologist)*
If no, attach trip report of previous site visit(s), if available.

Dates(s) of previous site visit(s) NA

3. Are aerial or other site photographs available? ☒ Yes ☐ No
If yes, please attach any available photo(s) to the site map to the report.

An aerial photo is presented as Figure 7-1 of this report. Additional site photos follow this checklist.

4. Provide an approximate breakdown of the land uses on the site:

_____ % Heavy Industrial	_____ 100 % Light Industrial	_____ % Urban
_____ % Residential	_____ % Rural	_____ % Agricultural ^b
_____ % Recreational ^a	_____ % Undisturbed	_____ % Other ^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

5. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: *1/4 mile*

_____ % Heavy Industrial	<u>100</u> % Light Industrial (building adjacent to airfield)	_____ % Urban
_____ % Residential	_____ % Rural	_____ % Agricultural ^b
_____ % Recreational ^a	_____ % Undisturbed	_____ % Other ^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, golf course, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

6. Has any movement of soil taken place at the site? ☐ Yes ☒ No
If yes, indicate the likely source of the disturbance, (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) degree of disturbance, and estimate when these events occurred.

NA

7. Do any sensitive environmental areas exist adjacent to or in proximity to the site, (e.g. Federal and State parks, National and State monuments, wetlands)?
Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information. See Table 1 for a list of contacts.

None observed.

Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.

Consulted Inventory of the Rare Species, Natural Communities, and Critical Areas of the Camp Lejeune Marine Corps Base, North Carolina (LeBlond, Fussell, and Braswell 1994) to determine if sensitive areas were present in the vicinity of the site. Also checked National Wetland Inventory mapping on Camp Lejeune GIS website (www.bakerenv.com/camplejeune_irp)

8. What type of facility is located at the site?

- ☐ Chemical ☐ Manufacturing ☐ Mixing
☐ Waste Disposal ☒ X Other (specify)

SWMU 336 consists of a pair of paint stripping vats located within Building AS-4106.

9. Identify the contaminants of potential concern (COPCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc).

Paint and paint stripping materials/ chemicals associated with paint stripping vats

10. Check any potential routes of off-site migration of contaminants observed at the site:

- ☐ Swales ☐ Depressions ☐ Drainage Ditches
☐ Runoff ☐ Windblown Particulates ☐ Vehicular Traffic
☒ X Other (specify): *floor drains leading to exterior of building/ sewer system*

11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)]).
According to Phase II CSI – depth to groundwater approx. 11.6 to 11.7 feet bgs.

12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)
Could not be determined – limited groundwater data at site. Suspected to be toward New River (1.25 miles east of the SWMU).

13. Is the direction of surface runoff apparent from site observations? ☒ X Yes ☐ No
If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

- ☐ Surface water ☒ X Groundwater ☐ Sewer
(exterior grass area direct infiltration to groundwater)
☐ Collection Impoundment

14. Is there a navigable water body or tributary to a navigable water body?
☐ Yes ☒ X No

15. Is there a water body anywhere on or in the vicinity of the site? If yes, also complete Section III.B.1: Aquatic Habitat Checklist -- Non-Flowing Systems and/or Section III.B.2: Aquatic Habitat Checklist -- Flowing Systems.

☐ Yes (approx. distance _____) ☒ X No

New River is approximately 1.25 miles east of the SWMU.

16. Is there evidence of flooding? ☐ Yes ☒ X No
Wetlands and flood plains are not always obvious. Do not answer "no" without confirming information. If yes, complete Section III.C: Wetland Habitat Checklist.

17. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. (Use a blank sheet if additional space is needed for text.)

NA

18. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? ☐ Yes ☒ X No
If yes, you are required to verify this information with the U.S. Fish and Wildlife Service or other appropriate agencies (see Table 1 for a list of contacts). If species' identities are known, please list them next.

19. Record weather conditions at the site at the time of the site visit when information for completion of this checklist was prepared:

DATE 16 February 2005

60s Temperature (°C/°F)

Wind (direction/speed): *light breeze*

Cloud Cover: *mostly clear skies, some cumulous clouds*

Normal daily high temperature (°C/°F): *approx. 60 °F*
(source: <http://www.city-data.com/city/Jacksonville-North-Carolina.html>)

Precipitation (rain, snow): *none*

20. Describe reasonable and likely future land and/or water use(s) at the site.

Study area will continue to be used for paint stripping for the foreseeable future.

21. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).

No historical chemical releases are known. Any spills that occurred within the building are properly contained and cleaned up according to Base personnel (as indicated in Phase II Report).

22. Identify the media (e.g., soil [surface or subsurface], surface water, air, groundwater) which are known or suspected to contain COCs.

Soil (surface and subsurface) and groundwater were identified as media of concern in the Phase II CSI.

II.A. SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.

SWMU 336 is located in the middle of a highly industrialized area of the Base, adjacent to the airfield. Access (to humans and larger bodied upper trophic level receptors) is restricted by fencing that secures the airfield. Terrestrial habitat in the study area is limited to a narrow stretch of maintained lawn, which extends approximately 25 feet out from the building and extends past the length of the building (100 feet; total grass area >2500 ft²). A mix of grasses and herbaceous species were growing in this lawn. No small mammals or other animals were observed during the site visit. Based on the distance to habitat that would be suitable for dwelling (rather than just foraging), it is unlikely that such receptors would be present in this area. It is possible that the lawn area supports terrestrial invertebrates; however, it should be noted that pesticide use along the perimeter of Base buildings is common. Avian receptors may access the maintained lawn, but use of this area by avian receptors is anticipated to be limited by the active industrial nature of the site (and also probably by lack of invertebrates in soil due to suspected pesticide use).

Checklist Completed by Heather G. Wojdak

Affiliation Michael Baker Jr., Inc.

Author Assisted by NA

Date 16 February 2005

III. HABITAT EVALUATION

III.A Terrestrial Habitat Checklist

III.A.1 Wooded

Are any wooded areas on or adjacent to the site? ☐ Yes ☒ No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.2: Shrub/Scrub

III.A.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? ☐ Yes ☒ No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.3: Open Field

III.A.3 Open Field

Are any open field areas on or adjacent to the site? ☐ Yes ☒ No

If yes, indicate the open field area on the attached site map and answer the following questions. If more than one open field area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual open field area. Distinguish between open field areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.4: Miscellaneous

III.A.4 Miscellaneous

Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub and open field? ☐ Yes ☒ No

If yes, indicate the area on the attached site map and answer the following questions. If more than one of these areas are present on or adjacent to the site, make additional copies of the following questions and fill out for each individual area. Distinguish between areas by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B: Aquatic Habitats.

III.B Aquatic Habitats

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

III.B.1 Non-Flowing Systems

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

☐ Yes ☒ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B.2: Flowing Systems

III.B.2 Flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

☐ Yes ☒ No

If yes, indicate the system on the attached site map and answer the following questions regarding the flowing system. If more than one flowing system is present on or adjacent to the site, make additional copies of the following questions and complete one set for each individual aquatic feature. Distinguish between flowing systems by using names or other designation. Clearly identify each area on the site map

If no, proceed to Section III.C: Wetlands Habitats.

III.C Wetland Habitats

Are any wetland¹ areas such as marshes or swamps on or adjacent to the site?

☐ Yes ☒ No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out one for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location). Clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination whether or not wetland areas are present.

If no wetland areas are present, proceed to Section III.D: Sensitive Environments and Receptors.

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas² exist adjacent to or within

¹Wetlands are defined in 40 CFR §232.2 as "Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at <http://nwi.fws.gov>. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

one-half mile of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*

No

2. Are any areas on or near (i.e., within one-half mile) the site owned or used by local tribes? If yes, describe.

No

3. Does the site serve or potentially serve as a habitat, foraging area or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*

No

4. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.

No

Sensitive Environments and Receptors Questions (continued)

5. Is the site used by any ecologically³, recreationally or commercially important species? If yes, explain.

No

³ Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to Table 2 at the end of this document for examples of sensitive environments.

³ Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms. These species' functions would not be replaced by more tolerant species or perform a critical ecological function (such as organic matter decomposition) and will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area if they serve as a food source for other species, but do not include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc).

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate and extent of contamination at the site?

- ☒ X Yes
- ☐ No
- ☐ Uncertain

Please provide an explanation for your answer.

See discussion in Section 7 of this report for details regarding exposure pathways.

2. Do existing data provide sufficient information on the nature, rate and extent of contamination in offsite affected areas?

- ☐ Yes
- ☐ No
- ☐ Uncertain
- ☒ X No offsite contamination

Please provide an explanation for your answer.

Soil contamination has been delimited; contaminated groundwater does not reach aquatic habitat.

3. Do existing data address potential migration pathways of contaminants at the site?

- ☒ X Yes *(based on sample locations)*
- ☐ No
- ☐ Uncertain

Please provide an explanation for your answer.

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

- ☒ X Yes
- ☐ No
- ☐ Uncertain
- ☐ No offsite contamination

Please provide an explanation for your answer.

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within one-half mile) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

None observed.

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 1 foot below ground surface (bgs). If yes, explain.

Yes for surface soil pathway – no for groundwater pathway (See Section 7).

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

Yes – terrestrial flora outside of building. Possibility of terrestrial inverts in this area. Unlimited access available to avian receptors – although use is expected to be limited in this industrialized area.

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

No – chemicals can leach to groundwater, but no evidence of groundwater discharge to receptor habitats.

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions.

What is the approximate distance from the contaminated area to the nearest watercourse?

- ☐ 0 feet (i.e., contamination has reached a watercourse)
- ☐ 1-10 feet
- ☐ 11-20 feet
- ☐ 21-50 feet
- ☐ 51-100 feet
- ☐ 101-200 feet
- ☐ > 200 feet
- ☐ > 500 feet
- ☐ X > 1000 feet

What is the slope of the ground in the contaminated area?

- ☒ 0-10%
- ☐ 10-30%
- ☐ > 30%

What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

- ☐ < 25%
- ☐ 25-75%
- ☒ > 75%

Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

- ☐ Yes
- ☒ No
- ☐ Do not know

Do any structures, pavement or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

- ☐ Yes
- ☒ No
- ☐ Do not know

10. Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

No – source underground pipes – volatilization limited by lawn.

11. Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

No

TABLE 1
SENSITIVE ENVIRONMENT CONTACTS

CONTACT	TELEPHONE #	SENSITIVE ENVIRONMENT
NC Division of Parks and Recreation – National Heritage Program	(919) 733-4181 Fax: (919) 715-3085	State Parks
		Areas Important to Maintenance of Unique Natural Communities
		Sensitive Areas Identified Under The National Estuary Program
		Designated State Natural Areas
		State Seashore, Lakeshore, and River Recreational Areas
		Rare species (state and federal Threatened and Endangered)
		Sensitive Aquatic Habitat
NC Planning and Natural Resources	(919) 846-9991	State Wild & Scenic Rivers
National Park Service Public Affairs Office	(404) 562-3103	National Seashore, Lakeshore and River Recreational Areas
		National Parks or Monuments
Internet	www.nps.gov/rivers	Federal Designated Wild & Scenic Rivers
US Forest Service	(828) 257-4253	Designated and Proposed Federal Wilderness and Natural Areas
	(828) 257-4864	National Preserves and Forests
	(828) 257-4810	Federal Land Designated for the protection of natural ecosystems.

CONTACT	TELEPHONE #	SENSITIVE ENVIRONMENT
NC Division of Water Quality	(919) 733-6510	Critical Areas Identified Under the Clean Lakes Program
	(919) 733-5083 <i>Ask for Clean Water Act 305b report</i>	State-Designated Areas for Protection or Maintenance of Aquatic Life
NC Division of Forest Resources	(919) 733-2162 x 234	State Preserves and Forests
US Fish & Wildlife Service	(919) 856-4520 x 11	Terrestrial Areas Utilized for Breeding by Large or Dense Aggregations of Animals
NC Wildlife Resources Commission	(252) 451-2534	National or State Wildlife Refuges
NOAA	(301) 713-3145 x 173	Marine Sanctuaries
NC Department of Cultural Resources	(919) 733-4763	National and State Historical Sites
NC Division of Coastal Management	(919) 733-2293	Areas Identified Under Coastal Protection Legislation
Internet	http://dcm2.enr.state.nc.us	Coastal Barriers or Units of a Coastal Barrier Resources System
NC Wildlife Resources Commission	(919) 733-3633	Spawning Areas Critical for the Maintenance of Fish/Shellfish Species within River, Lake or Coastal Tidal Waters.
		Migratory Pathways and Feeding Areas Critical for Maintenance of Anadromous Fish Species within River Reaches or Areas in Lakes or Coastal Tidal Waters in Which such Fish Spend Extended Periods of Time
		State Lands Designated for Wildlife or Game Management
US Army Corps of Engineers	(919) 876-8441, ext. 28	Wetlands

TABLE 2
EXAMPLES OF SENSITIVE ENVIRONMENTS

National Parks and National Monuments

Designated or Administratively Proposed Federal Wilderness Areas

National Preserves

National or State Wildlife Refuges

National Lakeshore Recreational Areas

Federal land designated for protection of natural ecosystems

State land designated for wildlife or game management

State designated Natural Areas

Federal or state designated Scenic or Wild River

All areas that provide or could potentially provide critical habitat¹ for state and federally listed Threatened or Endangered Species, those species that are currently petitioned for listing, and species designated by other agencies as sensitive or species of concern.

Marine Sanctuary

Areas identified under the Coastal Zone Management Act

Sensitive areas identified under the National Estuary Program or Near Coastal Waters Program

Critical areas identified under the Clean Lakes Program

National Seashore Recreational Area

Habitat known to be used by Federal designated or proposed endangered or threatened species

¹ Critical habitats are defined by the Endangered Species Act (50 CFR §424.02(d)) as:

- 1) Specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (i) essential to the conservation of the species and (ii) that may require special management considerations or protection, and
- 2) Specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary [of Interior] that such areas are essential for the conservation of the species.

Unit of Coastal Barrier Resources System

Coastal Barrier (undeveloped)

Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters

Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time

Terrestrial areas utilized for breeding by large or dense aggregations of animals

National river reach designated as Recreational

Habitat known to be used by state designated endangered or threatened species

Habitat known to be used by species under review as to its Federal endangered or threatened status

Coastal Barrier (partially developed)

Particular areas, relatively small in size, important to maintenance of unique biotic communities

State-designated areas for protection or maintenance of aquatic life

Wetlands

Photographs of SWMU 336 taken 16 February 2005

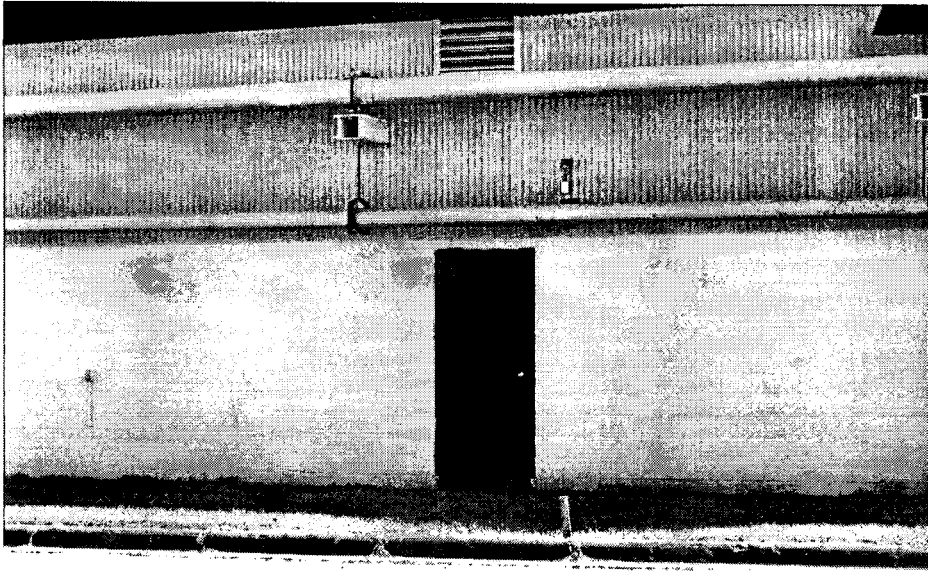


Photo 1. SWMU 336 – View of Building AS-4106 facing southeast.



Photo 2. View from red door of Building AS-4106 facing northeast.

Photographs of SWMU 336 taken 16 February 2005



Photo 3. View from red door of Building AS-4106 facing northwest.



Photo 4. View from red door of Building AS-4106 facing southwest.

Photographs of SWMU 336 taken 16 February 2005

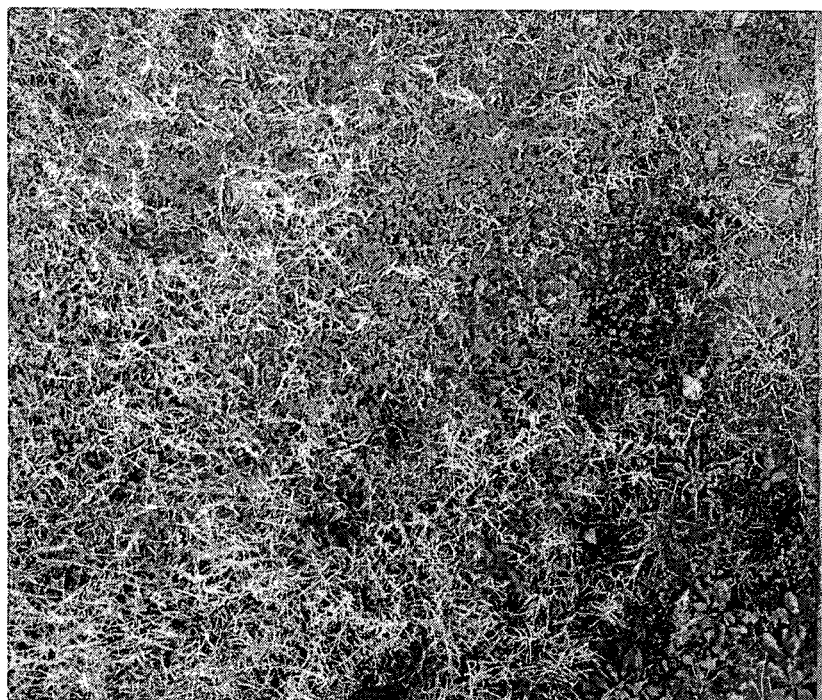


Photo 5. View of ground surface adjacent to Building AS-4106 near red door.

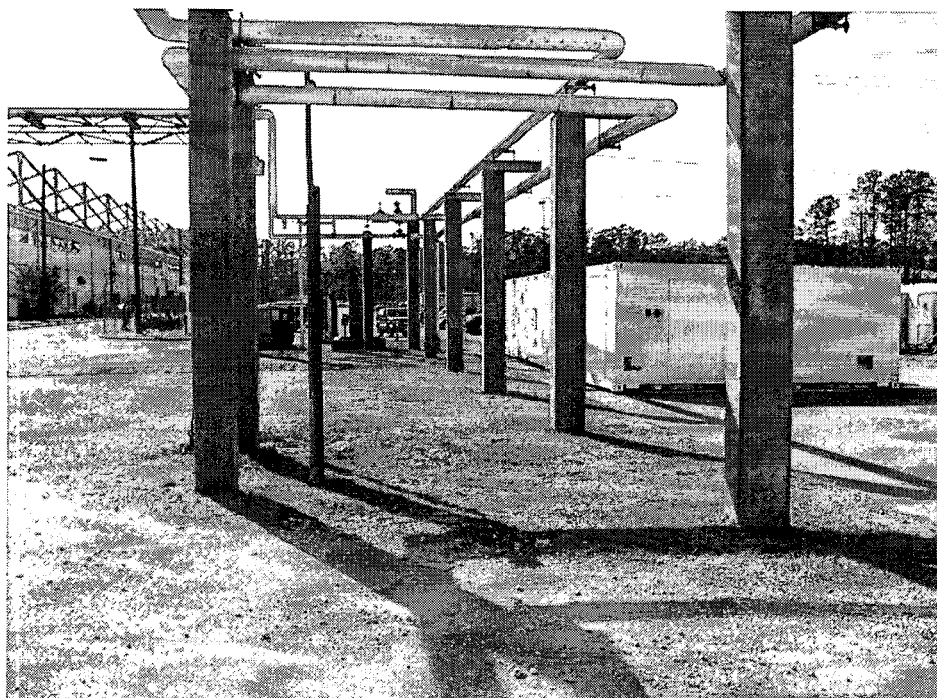


Photo 6. Area southwest of Building AS-4106.

Photographs of SWMU 336 taken 16 February 2005

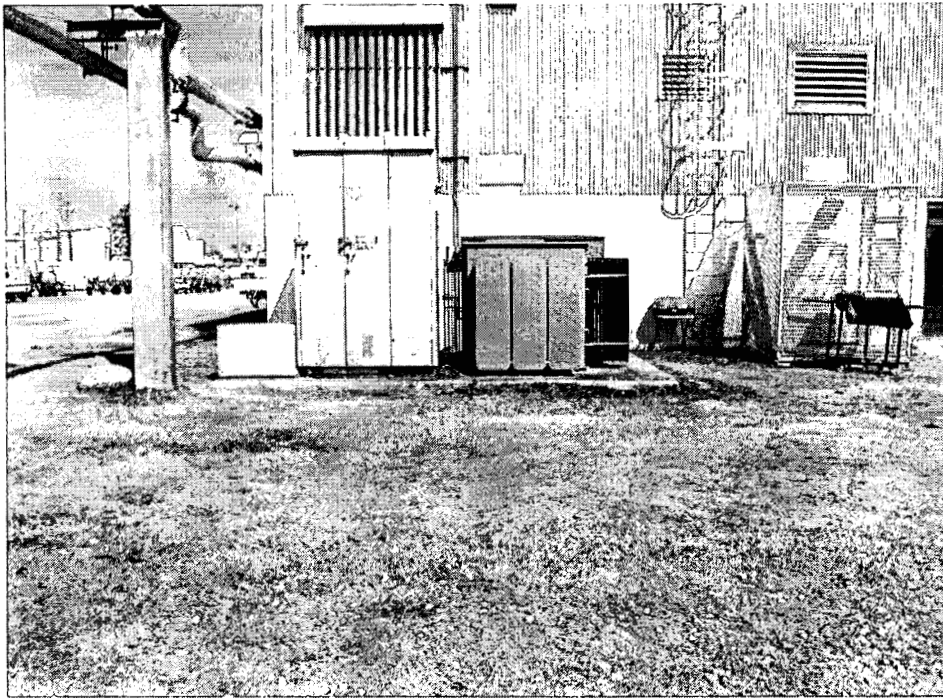


Photo 7. Southwest side of Building AS-4106 (viewed facing northeast).

Data Evaluated in the Ecological Risk Assessment

APPENDIX J

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)					
1,1,1-Trichloroethane	6 U	5 U	12 U	12 U	12 U
1,1,2,2-Tetrachloroethane	6 U	5 U	12 U	12 U	12 U
1,1,2-Trichloro-1,2,2-trifluoroethane	6 U	5 U	12 U	12 U	12 U
1,1,2-Trichloroethane	6 U	5 U	12 U	12 U	12 U
1,1-Dichloroethane	6 U	5 U	12 U	12 U	12 U
1,1-Dichloroethene	6 U	5 U	12 U	12 U	12 U
1,2,4-Trichlorobenzene	6 U	5 U	12 U	12 U	12 U
1,2-Dibromo-3-chloropropane	6 U	5 UJ	12 R	12 R	12 R
1,2-Dibromoethane	6 U	5 U	12 U	12 U	12 U
1,2-Dichlorobenzene	6 U	5 U	12 U	12 U	12 U
1,2-Dichloroethane	6 U	5 U	12 U	12 U	12 U
1,2-Dichloropropane	6 U	5 U	12 U	12 U	12 U
1,3-Dichlorobenzene	6 U	5 U	12 U	12 U	12 U
1,4-Dichlorobenzene	6 U	5 U	12 U	12 U	12 U
2-Butanone	14 U	12 U	12 U	12 U	12 U
2-Hexanone	14 U	12 U	12 U	12 U	12 U
4-Methyl-2-pentanone	14 U	12 U	12 U	12 U	12 U
Acetone	33	8 J	12 U	12 U	12 UJ
Benzene	6 U	5 U	12 U	12 U	12 U
Bromodichloromethane	6 U	5 U	12 U	12 U	12 U
Bromoform	6 U	5 U	12 U	12 U	12 U
Bromomethane	6 UJ	5 UJ	12 U	12 U	12 U
Carbon disulfide	6 U	5 U	12 U	12 U	12 U
Carbon tetrachloride	6 U	5 U	12 U	12 U	12 U
Chlorobenzene	6 U	5 U	12 U	12 U	12 U
Chloroethane	6 U	5 U	12 U	12 U	12 U
Chloroform	6 U	5 U	12 U	12 U	12 U
Chloromethane	6 U	5 U	12 U	12 U	12 U
cis-1,2-Dichloroethene	6 U	5 U	12 U	12 U	12 U
cis-1,3-Dichloropropene	6 U	5 U	12 U	12 U	12 U
Cyclohexane	6 U	5 U	12 U	12 U	12 U

NA - Not analyzed

APPENDIX J

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1
Volatile Organic Compounds (ug/kg)(Cont.)					
Dibromochloromethane	6 U	5 U	12 U	12 U	12 U
Dichlorodifluoromethane	6 U	5 U	12 U	12 U	12 U
Ethylbenzene	6 U	5 U	12 U	12 U	12 U
Isopropylbenzene	6 U	5 U	12 U	12 U	12 U
Methyl acetate	6 U	5 U	12 U	12 U	12 U
Methylcyclohexane	6 U	5 U	12 U	12 U	12 U
Methylene chloride	12	28	12 U	12 U	12 U
Methyl-tert-butyl ether (MTBE)	6 U	5 U	12 U	12 U	12 U
o-Xylene	NA	NA	12 U	12 U	12 U
Styrene	6 U	5 U	12 U	12 U	12 U
Tetrachloroethene	6 U	5 U	12 U	12 U	12 U
Toluene	3 J	5 U	12 U	12 U	12 U
trans-1,2-Dichloroethene	6 U	5 U	12 U	12 U	12 U
trans-1,3-Dichloropropene	6 U	5 U	12 U	12 U	12 U
Trichloroethene	6 U	5 U	12 U	12 U	12 U
Trichlorofluoromethane	6 U	5 U	12 U	12 U	12 U
Vinyl chloride	6 U	5 U	12 U	12 U	12 U
Xylenes (total)	1 J	14 U	NA	NA	NA
Semivolatile Organic Compounds (ug/Kg)					
1,1'-Biphenyl	400 U	380 U	NA	NA	NA
2,2'-Oxybis(1-chloropropane)	400 U	380 U	NA	NA	NA
2,4,5-Trichlorophenol	400 U	380 U	NA	NA	NA
2,4,6-Trichlorophenol	400 U	380 U	NA	NA	NA
2,4-Dichlorophenol	400 U	380 U	NA	NA	NA
2,4-Dimethylphenol	400 U	380 U	NA	NA	NA
2,4-Dinitrophenol	2100 UJ	2000 UJ	NA	NA	NA
2,4-Dinitrotoluene	400 U	380 U	NA	NA	NA
2,6-Dinitrotoluene	400 U	380 U	NA	NA	NA
2-Chloronaphthalene	400 U	380 U	NA	NA	NA
2-Chlorophenol	400 U	380 U	NA	NA	NA
2-Methylnaphthalene	400 U	380 U	NA	NA	NA

NA - Not analyzed

APPENDIX J

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/Kg)(Cont.)					
2-Methylphenol	400 U	380 U	NA	NA	NA
2-Nitroaniline	800 U	760 U	NA	NA	NA
2-Nitrophenol	400 U	380 U	NA	NA	NA
3,3'-Dichlorobenzidine	800 U	760 U	NA	NA	NA
3-Nitroaniline	800 U	760 U	NA	NA	NA
4,6-Dinitro-2-methylphenol	800 U	760 U	NA	NA	NA
4-Bromophenyl phenyl ether	400 U	380 U	NA	NA	NA
4-Chloro-3-methylphenol	400 U	380 U	NA	NA	NA
4-Chloroaniline	400 U	380 U	NA	NA	NA
4-Chlorophenyl phenyl ether	400 U	380 U	NA	NA	NA
4-Methylphenol	400 U	380 U	NA	NA	NA
4-Nitroaniline	800 U	760 U	NA	NA	NA
4-Nitrophenol	800 U	760 U	NA	NA	NA
Acenaphthene	400 U	380 U	NA	NA	NA
Acenaphthylene	400 U	380 U	NA	NA	NA
Acetophenone	400 U	380 U	NA	NA	NA
Anthracene	400 U	380 U	NA	NA	NA
Atrazine	400 U	380 U	NA	NA	NA
Benzaldehyde	400 U	380 U	NA	NA	NA
Benzo(a)anthracene	400 U	380 U	NA	NA	NA
Benzo(a)pyrene	400 U	380 U	NA	NA	NA
Benzo(b)fluoranthene	400 U	380 U	NA	NA	NA
Benzo(k)fluoranthene	400 U	380 U	NA	NA	NA
Benzo(g,h,i)perylene	400 U	380 U	NA	NA	NA
Bis(2-chloroethoxy)methane	400 U	380 U	NA	NA	NA
Bis(2-Chloroethyl) ether	400 U	380 U	NA	NA	NA
Bis(2-ethylhexyl)phthalate	860	100 J	NA	NA	NA
Butyl benzyl phthalate	860	380 U	NA	NA	NA
Caprolactam	400 U	380 U	NA	NA	NA
Carbazole	400 U	380 U	NA	NA	NA
Chrysene	400 U	380 U	NA	NA	NA

NA - Not analyzed

APPENDIX J

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

Sample ID	SWMU336-TW01-00	SWMU336-TW02-00	SWMU336-TW03-00	SWMU336-TW05-00	SWMU336-TW06-00
Sample Date	03-20-2002	03-20-2002	06-23-2003	06-23-2003	06-23-2003
Sample Depth (ft)	0-1	0-1	0-1	0-1	0-1
Semivolatile Organic Compounds (ug/Kg)(Cont.)					
Dibenz(a,h)anthracene	400 U	380 U	NA	NA	NA
Dibenzofuran	400 U	380 U	NA	NA	NA
Diethyl phthalate	400 U	380 U	NA	NA	NA
Dimethyl phthalate	400 U	380 U	NA	NA	NA
Di-n-butyl phthalate	400 U	380 U	NA	NA	NA
Di-n-octylphthalate	110 J	380 U	NA	NA	NA
Fluoranthene	400 U	380 U	NA	NA	NA
Fluorene	400 U	380 U	NA	NA	NA
Hexachlorobenzene	400 U	380 U	NA	NA	NA
Hexachlorobutadiene	400 U	380 U	NA	NA	NA
Hexachlorocyclopentadiene	400 U	380 U	NA	NA	NA
Hexachloroethane	400 U	380 U	NA	NA	NA
Indeno(1,2,3-cd)pyrene	400 U	380 U	NA	NA	NA
Isophorone	400 U	380 U	NA	NA	NA
Naphthalene	400 U	380 U	NA	NA	NA
Nitrobenzene	400 U	380 U	NA	NA	NA
n-Nitroso-di-n-propylamine	400 U	380 U	NA	NA	NA
n-Nitrosodiphenylamine	400 U	380 U	NA	NA	NA
Pentachlorophenol	800 U	760 U	NA	NA	NA
Phenanthrene	400 U	380 U	NA	NA	NA
Phenol	400 U	380 U	NA	NA	NA
Pyrene	400 U	380 U	NA	NA	NA
Total Metals (mg/Kg)					
Arsenic	0.3 J	0.68 J	0.64 U	0.81 J	0.63 U
Barium	17.6	48.2	13.6 J	10.8 J	11.1 J
Cadmium	1.8	4.4	0.49 J	0.15 J	0.27 J
Chromium	13.8	15.3	0.14 U	0.14 U	0.14 U
Lead	18.9 J	17.7 J	7.7	8.2	6.1
Mercury	0.06	0.06	0.11 U	0.11 U	0.12 U
Selenium	0.55 U	0.62	0.69 UJ	0.71 UJ	0.68 UJ
Silver	0.11 U	0.1 U	0.23 UJ	0.24 UJ	0.23 UJ

NA - Not analyzed

APPENDIX I

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmetic Mean Positive Detects	Median Positive Detects	Arithmetic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Volatile Organic Compounds (ug/kg)										
1,1,1-Trichloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,1,2,2-Tetrachloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,1,2-Trichloro-1,2,2-trifluoroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,1,2-Trichloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,1-Dichloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,1-Dichloroethene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,2,4-Trichlorobenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,2-Dibromo-3-chloropropane	5 UJ	6 U	0	0	0/2	NA	NA	2.75	0.3536	4.3286
1,2-Dibromoethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,2-Dichlorobenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,2-Dichloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,2-Dichloropropane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,3-Dichlorobenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
1,4-Dichlorobenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
2-Butanone	12 U	14 U	0	0	0/5	NA	NA	6.2	0.4472	6.6264
2-Hexanone	12 U	14 U	0	0	0/5	NA	NA	6.2	0.4472	6.6264
4-Methyl-2-pentanone	12 U	14 U	0	0	0/5	NA	NA	6.2	0.4472	6.6264
Acetone	12 UJ	12 UJ	8 J	33	2/5	20.5	20.5	11.8	11.8828	23.129
Benzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Bromodichloromethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Bromoform	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Bromomethane	5 UJ	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Carbon disulfide	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Carbon tetrachloride	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Chlorobenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Chloroethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Chloroform	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Chloromethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
cis-1,2-Dichloroethene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
cis-1,3-Dichloropropene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Cyclohexane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055

NA - Not applicable

APPENDIX I

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmetic Mean Positive Detects	Median Positive Detects	Arithmetic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Volatile Organic Compounds (ug/kg)(Cont.)										
Dibromochloromethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Dichlorodifluoromethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Ethylbenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Isopropylbenzene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
m- and p- Xylenes	12 U	12 U	0	0	0/3	NA	NA	6	0	6
Methyl acetate	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Methylcyclohexane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Methylene chloride	12 U	12 U	12	28	2/5	20	20	11.6	9.5289	20.6848
Methyl-tert-butyl ether (MTBE)	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
o-Xylene	12 U	12 U	0	0	0/3	NA	NA	6	0	6
Styrene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Tetrachloroethene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Toluene	5 U	12 U	3 J	3 J	1/5	3	3	4.7	1.7889	6.4055
trans-1,2-Dichloroethene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
trans-1,3-Dichloropropene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Trichloroethene	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Trichlorofluoromethane	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Vinyl chloride	5 U	12 U	0	0	0/5	NA	NA	4.7	1.7889	6.4055
Xylenes (total)	14 U	14 U	1 J	1 J	1/2	1	1	4	4.2426	22.9411
Semivolatile Organic Compounds (ug/kg)										
1,1'-Biphenyl	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,2'-Oxybis(1-chloropropane)	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,4,5-Trichlorophenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,4,6-Trichlorophenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,4-Dichlorophenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,4-Dimethylphenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,4-Dinitrophenol	2000 UJ	2100 UJ	0	0	0/2	NA	NA	1025	35.3553	1182.8435
2,4-Dinitrotoluene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2,6-Dinitrotoluene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2-Chloronaphthalene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2-Chlorophenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689

NA - Not applicable

APPENDIX I

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmetic Mean Positive Detects	Median Positive Detects	Arithmetic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Semivolatile Organic Compounds (ug/kg)(Cont.)										
2-Methylnaphthalene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2-Methylphenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
2-Nitroaniline	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
2-Nitrophenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
3,3'-Dichlorobenzidine	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
3-Nitroaniline	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
4,6-Dinitro-2-methylphenol	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
4-Bromophenyl phenyl ether	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
4-Chloro-3-methylphenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
4-Chloroaniline	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
4-Chlorophenyl phenyl ether	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
4-Methylphenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
4-Nitroaniline	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
4-Nitrophenol	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
Acenaphthene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Acenaphthylene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Acetophenone	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Anthracene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Atrazine	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzaldehyde	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzo(a)anthracene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzo(a)pyrene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzo(b)fluoranthene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzo(k)fluoranthene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Benzo(g,h,i)perylene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Bis(2-chloroethoxy)methane	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Bis(2-Chloroethyl)ether	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Bis(2-ethylhexyl)phthalate	0	0	100 J	860	2/2	480	480	480	537.4012	2879.2247
Butyl benzyl phthalate	380 U	380 U	860	860	1/2	860	860	525	473.7615	2640.1056
Caprolactam	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Carbazole	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689

NA - Not applicable

APPENDIX I

DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 336 RCRA FACILITY INVESTIGATION (CTO-0091) MCB CAMP LEJEUNE, NORTH CAROLINA

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmetic Mean Positive Detects	Median Positive Detects	Arithmetic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Semivolatile Organic Compounds (ug/kg)(Cont.)										
Chrysene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Dibenz(a,h)anthracene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Dibenzofuran	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Diethyl phthalate	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Dimethyl phthalate	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Di-n-butyl phthalate	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Di-n-octylphthalate	380 U	380 U	110 J	110 J	1/2	110	110	150	56.5685	402.5498
Fluoranthene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Fluorene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Hexachlorobenzene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Hexachlorobutadiene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Hexachlorocyclopentadiene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Hexachloroethane	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Indeno(1,2,3-cd)pyrene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Isophorone	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Naphthalene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Nitrobenzene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
n-Nitroso-di-n-propylamine	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
n-Nitrosodiphenylamine	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Pentachlorophenol	760 U	800 U	0	0	0/2	NA	NA	390	14.1421	453.1373
Phenanthrene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Phenol	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Pyrene	380 U	400 U	0	0	0/2	NA	NA	195	7.0711	226.5689
Total Metals (mg/kg)										
Arsenic	0.63 U	0.64 U	0.3 J	0.81 J	3/5	0.5967	0.68	0.485	0.2419	0.7156
Barium	0	0	10.8 J	48.2	5/5	20.26	13.6	20.26	15.8546	35.3756
Cadmium	0	0	0.15 J	4.4	5/5	1.422	0.49	1.422	1.7906	3.1291
Chromium	0.14 U	0.14 U	13.8	15.3	2/5	14.55	14.55	5.862	7.9487	13.4402
Lead	0	0	6.1	18.9 J	5/5	11.72	8.2	11.72	6.0714	17.5084
Mercury	0.11 U	0.12 U	0.06	0.06	2/5	0.06	0.06	0.058	0.0027	0.0606
Selenium	0.55 U	0.71 UJ	0.62	0.62	1/5	0.62	0.62	0.387	0.134	0.5148
Silver	0.1 U	0.24 UJ	0	0	0/5	NA	NA	0.091	0.0352	0.1246

NA - Not applicable

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DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT

SWMU 336

RCRA FACILITY INVESTIGATION (CTO-0091)

MCB CAMP LEJEUNE, NORTH CAROLINA

	Log Arithmetic Mean Half Non-Detects	Log Standard Deviation	Degree of Freedom	H Statistic	Log Upper 95% Confidence Level	Location of Maximum Detect
Volatile Organic Compounds (ug/kg)						
1,1,1-Trichloroethane	1.478	0.4344	4	2.947	9.138	
1,1,2,2-Tetrachloroethane	1.478	0.4344	4	2.947	9.138	
1,1,2-Trichloro-1,2,2-trifluoroethane	1.478	0.4344	4	2.947	9.138	
1,1,2-Trichloroethane	1.478	0.4344	4	2.947	9.138	
1,1-Dichloroethane	1.478	0.4344	4	2.947	9.138	
1,1-Dichloroethene	1.478	0.4344	4	2.947	9.138	
1,2,4-Trichlorobenzene	1.478	0.4344	4	2.947	9.138	
1,2-Dibromo-3-chloropropane	1.0075	0.1289	1	2.75	3.9365	
1,2-Dibromoethane	1.478	0.4344	4	2.947	9.138	
1,2-Dichlorobenzene	1.478	0.4344	4	2.947	9.138	
1,2-Dichloroethane	1.478	0.4344	4	2.947	9.138	
1,2-Dichloropropane	1.478	0.4344	4	2.947	9.138	
1,3-Dichlorobenzene	1.478	0.4344	4	2.947	9.138	
1,4-Dichlorobenzene	1.478	0.4344	4	2.947	9.138	
2-Butanone	1.8226	0.0689	4	2.035	6.6531	
2-Hexanone	1.8226	0.0689	4	2.035	6.6531	
4-Methyl-2-pentanone	1.8226	0.0689	4	2.035	6.6531	
Acetone	2.1902	0.7408	4	4.062	52.9399	SWMU336-TW01-00
Benzene	1.478	0.4344	4	2.947	9.138	
Bromodichloromethane	1.478	0.4344	4	2.947	9.138	
Bromoform	1.478	0.4344	4	2.947	9.138	
Bromomethane	1.478	0.4344	4	2.947	9.138	
Carbon disulfide	1.478	0.4344	4	2.947	9.138	
Carbon tetrachloride	1.478	0.4344	4	2.947	9.138	
Chlorobenzene	1.478	0.4344	4	2.947	9.138	
Chloroethane	1.478	0.4344	4	2.947	9.138	
Chloroform	1.478	0.4344	4	2.947	9.138	
Chloromethane	1.478	0.4344	4	2.947	9.138	
cis-1,2-Dichloroethene	1.478	0.4344	4	2.947	9.138	
cis-1,3-Dichloropropene	1.478	0.4344	4	2.947	9.138	
Cyclohexane	1.478	0.4344	4	2.947	9.138	

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DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 336 RCRA FACILITY INVESTIGATION (CTO-0091) MCB CAMP LEJEUNE, NORTH CAROLINA

	Log Arithmetic Mean Half Non-Detects	Log Standard Deviation	Degree of Freedom	H Statistic	Log Upper 95% Confidence Level	Location of Maximum Detect
Volatile Organic Compounds (ug/kg)(Cont.)						
Dibromochloromethane	1.478	0.4344	4	2.947	9.138	
Dichlorodifluoromethane	1.478	0.4344	4	2.947	9.138	
Ethylbenzene	1.478	0.4344	4	2.947	9.138	
Isopropylbenzene	1.478	0.4344	4	2.947	9.138	
m- and p- Xylenes	1.7918	0	2	2.75	6.0002	
Methyl acetate	1.478	0.4344	4	2.947	9.138	
Methylcyclohexane	1.478	0.4344	4	2.947	9.138	
Methylene chloride	2.2385	0.6811	4	3.662	41.1631	SWMU336-TW02-00
Methyl-tert-butyl ether (MTBE)	1.478	0.4344	4	2.947	9.138	
o-Xylene	1.7918	0	2	2.75	6.0002	
Styrene	1.478	0.4344	4	2.947	9.138	
Tetrachloroethene	1.478	0.4344	4	2.947	9.138	
Toluene	1.478	0.4344	4	2.947	9.138	SWMU336-TW01-00
trans-1,2-Dichloroethene	1.478	0.4344	4	2.947	9.138	
trans-1,3-Dichloropropene	1.478	0.4344	4	2.947	9.138	
Trichloroethene	1.478	0.4344	4	2.947	9.138	
Trichlorofluoromethane	1.478	0.4344	4	2.947	9.138	
Vinyl chloride	1.478	0.4344	4	2.947	9.138	
Xylenes (total)	0.973	1.376	1	2.75	299.9717	SWMU336-TW01-00
Semivolatile Organic Compounds (ug/kg)						
1,1'-Biphenyl	5.2727	0.0363	1	2.75	215.548	
2,2'-Oxybis(1-chloropropane)	5.2727	0.0363	1	2.75	215.548	
2,4,5-Trichlorophenol	5.2727	0.0363	1	2.75	215.548	
2,4,6-Trichlorophenol	5.2727	0.0363	1	2.75	215.548	
2,4-Dichlorophenol	5.2727	0.0363	1	2.75	215.548	
2,4-Dimethylphenol	5.2727	0.0363	1	2.75	215.548	
2,4-Dinitrophenol	6.9322	0.0345	1	2.75	1127.4008	
2,4-Dinitrotoluene	5.2727	0.0363	1	2.75	215.548	
2,6-Dinitrotoluene	5.2727	0.0363	1	2.75	215.548	
2-Chloronaphthalene	5.2727	0.0363	1	2.75	215.548	
2-Chlorophenol	5.2727	0.0363	1	2.75	215.548	

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DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 336 RCRA FACILITY INVESTIGATION (CTO-0091) MCB CAMP LEJEUNE, NORTH CAROLINA

	Log Arithmetic Mean Half Non-Detects	Log Standard Deviation	Degree of Freedom	H Statistic	Log Upper 95% Confidence Level	Location of Maximum Detect
Semivolatile Organic Compounds (ug/kg)(Con						
2-Methylnaphthalene	5.2727	0.0363	1	2.75	215.548	
2-Methylphenol	5.2727	0.0363	1	2.75	215.548	
2-Nitroaniline	5.9658	0.0363	1	2.75	431.0758	
2-Nitrophenol	5.2727	0.0363	1	2.75	215.548	
3,3'-Dichlorobenzidine	5.9658	0.0363	1	2.75	431.0758	
3-Nitroaniline	5.9658	0.0363	1	2.75	431.0758	
4,6-Dinitro-2-methylphenol	5.9658	0.0363	1	2.75	431.0758	
4-Bromophenyl phenyl ether	5.2727	0.0363	1	2.75	215.548	
4-Chloro-3-methylphenol	5.2727	0.0363	1	2.75	215.548	
4-Chloroaniline	5.2727	0.0363	1	2.75	215.548	
4-Chlorophenyl phenyl ether	5.2727	0.0363	1	2.75	215.548	
4-Methylphenol	5.2727	0.0363	1	2.75	215.548	
4-Nitroaniline	5.9658	0.0363	1	2.75	431.0758	
4-Nitrophenol	5.9658	0.0363	1	2.75	431.0758	
Acenaphthene	5.2727	0.0363	1	2.75	215.548	
Acenaphthylene	5.2727	0.0363	1	2.75	215.548	
Acetophenone	5.2727	0.0363	1	2.75	215.548	
Anthracene	5.2727	0.0363	1	2.75	215.548	
Atrazine	5.2727	0.0363	1	2.75	215.548	
Benzaldehyde	5.2727	0.0363	1	2.75	215.548	
Benzo(a)anthracene	5.2727	0.0363	1	2.75	215.548	
Benzo(a)pyrene	5.2727	0.0363	1	2.75	215.548	
Benzo(b)fluoranthene	5.2727	0.0363	1	2.75	215.548	
Benzo(k)fluoranthene	5.2727	0.0363	1	2.75	215.548	
Benzo(g,h,i)perylene	5.2727	0.0363	1	2.75	215.548	
Bis(2-chloroethoxy)methane	5.2727	0.0363	1	2.75	215.548	
Bis(2-Chloroethyl)ether	5.2727	0.0363	1	2.75	215.548	
Bis(2-ethylhexyl)phthalate	5.6811	1.5215	1	2.75	61249.2035	SWMU336-TW01-00
Butyl benzyl phthalate	6.002	1.0677	1	2.75	13469.2777	SWMU336-TW01-00
Caprolactam	5.2727	0.0363	1	2.75	215.548	
Carbazole	5.2727	0.0363	1	2.75	215.548	

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DATA EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT SWMU 336 RCRA FACILITY INVESTIGATION (CTO-0091) MCB CAMP LEJEUNE, NORTH CAROLINA

	Log Arithmetic Mean Half Non-Detects	Log Standard Deviation	Degree of Freedom	H Statistic	Log Upper 95% Confidence Level	Location of Maximum Detect
Semivolatile Organic Compounds (ug/kg)(Con						
Chrysene	5.2727	0.0363	1	2.75	215.548	
Dibenz(a,h)anthracene	5.2727	0.0363	1	2.75	215.548	
Dibenzofuran	5.2727	0.0363	1	2.75	215.548	
Diethyl phthalate	5.2727	0.0363	1	2.75	215.548	
Dimethyl phthalate	5.2727	0.0363	1	2.75	215.548	
Di-n-butyl phthalate	5.2727	0.0363	1	2.75	215.548	
Di-n-octylphthalate	4.9738	0.3865	1	2.75	450.9544	SWMU336-TW01-00
Fluoranthene	5.2727	0.0363	1	2.75	215.548	
Fluorene	5.2727	0.0363	1	2.75	215.548	
Hexachlorobenzene	5.2727	0.0363	1	2.75	215.548	
Hexachlorobutadiene	5.2727	0.0363	1	2.75	215.548	
Hexachlorocyclopentadiene	5.2727	0.0363	1	2.75	215.548	
Hexachloroethane	5.2727	0.0363	1	2.75	215.548	
Indeno(1,2,3-cd)pyrene	5.2727	0.0363	1	2.75	215.548	
Isophorone	5.2727	0.0363	1	2.75	215.548	
Naphthalene	5.2727	0.0363	1	2.75	215.548	
Nitrobenzene	5.2727	0.0363	1	2.75	215.548	
n-Nitroso-di-n-propylamine	5.2727	0.0363	1	2.75	215.548	
n-Nitrosodiphenylamine	5.2727	0.0363	1	2.75	215.548	
Pentachlorophenol	5.9658	0.0363	1	2.75	431.0758	
Phenanthrene	5.2727	0.0363	1	2.75	215.548	
Phenol	5.2727	0.0363	1	2.75	215.548	
Pyrene	5.2727	0.0363	1	2.75	215.548	
Total Metals (mg/kg)						
Arsenic	-0.819	0.48	4	2.947	1.0035	SWMU336-TW05-00
Barium	2.828	0.6173	4	3.662	63.3583	SWMU336-TW02-00
Cadmium	-0.3701	1.3855	4	7.12	250.1561	SWMU336-TW02-00
Chromium	-0.5251	2.9226	4	13.97	31087025419	SWMU336-TW02-00
Lead	2.3533	0.5173	4	3.287	28.1425	SWMU336-TW01-00
Mercury	-2.8482	0.0477	4	2.035	0.0609	SWMU336-TW01-00, SWMU336-TW02-00
Selenium	-0.9895	0.3034	4	2.651	0.582	SWMU336-TW02-00
Silver	-2.4684	0.4395	4	2.947	0.1783	